NOVEMBER 1984

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TELEVISION

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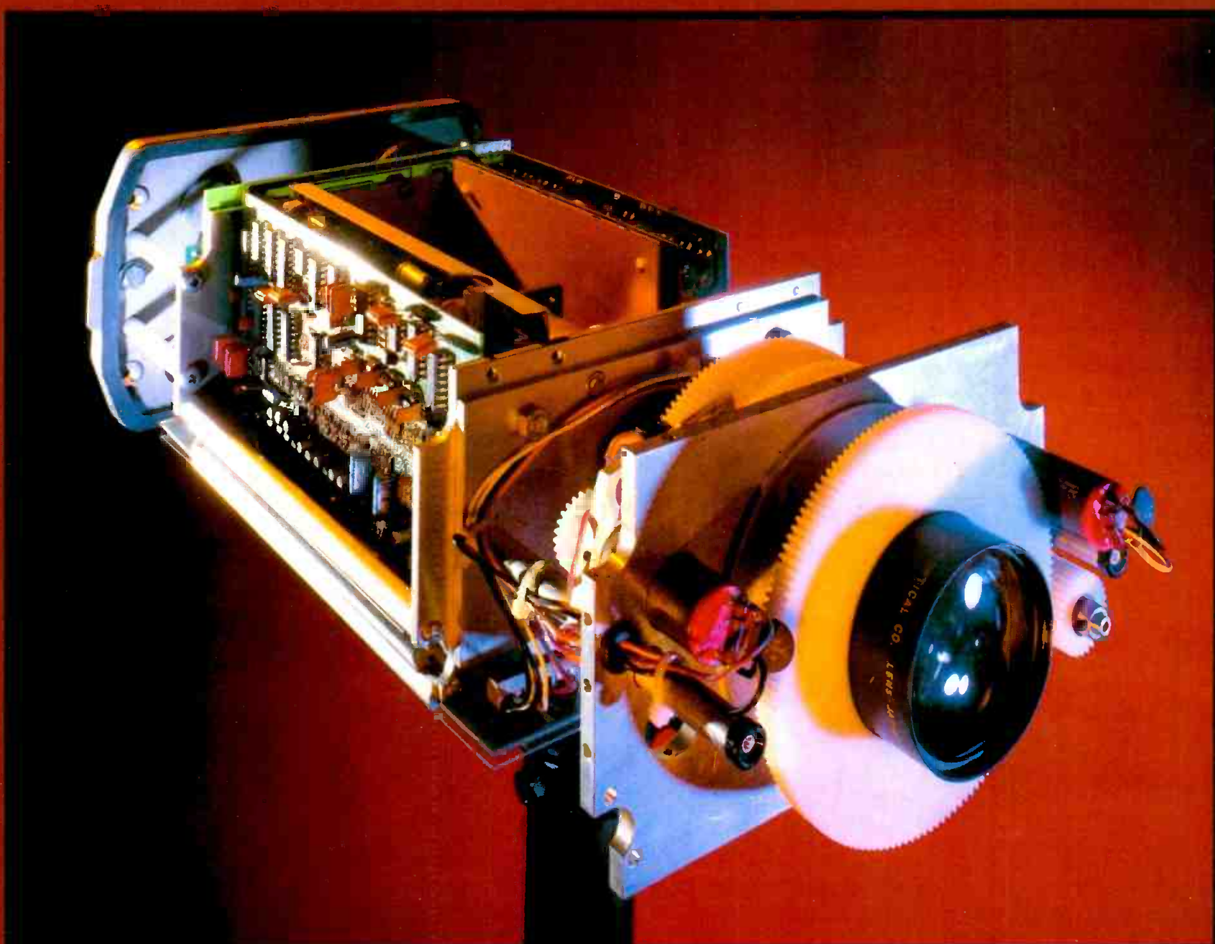

All about Lenses • DX-TV

Remote Control for VCRs

Variable IF Sound Channel

Grundig's VHS Machine

Simple CRT Tester/booster

VCR Clinic • TV Fault Finding

TELEVISION

November 1984 **Vol. 35, No. 1 Issue 409**

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

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QUERIES
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television,* but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.
Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

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16 The Tangle Web — *Les Lawry-Johns*
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17 Teletopics

19 30V Battery Eliminator — *Peter H. Dolman, T. Eng.*
A simple oscillator plus rectifier circuit that produces a 30V tuning supply.

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Type	Price (£)	Type	Price (£)	Type	Price (£)
BD244A	0.65	BF258	0.30	BT101/300	1.15
BD375	0.32	BF259	0.32	BT101/500	1.25
BD410	0.76	BF262	0.30	BT102/300	1.35
BD434	0.68	BF263	0.30	BT102/500	1.65
BD436	0.68	BF270	0.30	BT106	1.50
BD437	0.76	BF271	0.26	BT108	1.30
BD438	0.75	BF273	0.18	BT109	1.18
BD439	0.68	BF274	0.32	BT116	1.25
BD507	0.48	BF323	0.92	BT119	3.62
BD508	0.53	BF336	0.26	BT120	3.60
BD509	0.54	BF337	0.26	BT121	3.02
BD510	0.48	BF338	0.26	BT138/600	1.30
BD517	0.56	BF355	0.42	BT151/560R	0.90
BD520	0.66	BF363	0.82	BT151/300R	1.15
BD699	1.25	BF367	0.24	BTY79/400R	2.80
BD707	0.88	BF371	0.27	BU100A	2.30
BDX18	2.35	BF422	0.38	BU104	2.00
BDX32	2.10	BF450	0.38	BU105	1.20
BF115	0.32	BF457	0.33	BU105/02	1.56
BF117	0.54	BF458	0.36	BU108	1.80
BF119	0.82	BF459	0.44	BU124	1.75
BF120	0.38	BFR39	0.22	BU126	1.25
BF123	0.40	BFR40	0.22	BU133	1.80
BF125	0.42	BFR41	0.22	BU204	1.35
BF127	0.38	BFR51	0.30	BU205	1.30
BF152	0.16	BFR61	0.32	BU206	1.70
BF154	0.23	BFR62	0.28	BU208	1.55
BF157	0.40	BFR88	0.34	BU208A	1.63
BF158	0.22	BFR90	1.72	BU208/02	2.05
BF159	0.24	BFT41	0.38	BU326S	1.75
BF160	0.23	BFT43	0.38	BU407	1.65
BF167	0.30	BFW10	0.79	BU407D	1.80
BF173	0.25	BFW44	0.76	BUX80	3.70
BF177	0.42	BFX29	0.28	BUY20	1.75
BF178	0.30	BFX30	0.30	BUY69A	2.60
BF179	0.32	BFX80	3.56	BUY69B	1.98
BF180	0.35	BFX84	0.24	BY101	0.48
BF181	0.35	BFX85	0.26	BY118	1.10
BF182	0.32	BFX86	0.26	BY122	0.68
BF183	0.32	BFX87	0.26	BY126	0.12
BF184	0.32	BFX89	0.65	BY127	0.10
BF185	0.32	BFY50	0.21	BY133	0.16
BF194	0.08	BFY51	0.21	BY135	0.25
BF195	0.10	BFY52	0.21	BY164	0.44
BF196	0.10	BFY57	0.40	BY179	0.66
BF197	0.10	BFY90	0.90	BY182	0.87
BF198	0.14	BFY90S	1.34	BY184	0.40
BF199	0.16	BR100	0.20	BY187	0.72
BF200	0.26	BR101	0.44	BY189	4.75
BF222	0.48	BR103	0.58	BY198	0.44
BF224	0.20	BRC4443	1.76	BY199	0.47
BF224J	0.16	BRY39	0.38	BY206	0.24
BF240	0.20	BRY56	0.42	BY207	0.24
BF241	0.20	BRY61	0.86	BY210/400	0.25
BF244	0.26	BSS17	0.56	BY210/600	0.26
BF244A	0.28	BSS27	0.92	BY210/800	0.30
BF244C	0.24	BSX19	0.34	BY223	1.20
BF245A	0.28	BSX20	0.34	BY227	0.26
BF254	0.15	BSX59	0.62	BY229	0.30
BF256	0.40	BSX76	0.29	BY238	0.68
BF257	0.32	BT100A/02	0.94	BYX10	0.24

Type	Price (£)	Type	Price (£)	Type	Price (£)
BYX36/150	0.22	TIC106A	0.70	2AC1449	0.63
BYX36/600	0.28	TIP30A	0.46	2SC1507	0.63
BYX48/300	0.72	TIP31C	0.54	2SC1678	1.06
BYX49/300	0.47	TIP32	0.40	2SC1758	0.68
BYX55/350	0.29	TIP32C	0.60	2SC1909	1.20
BYX55/600	0.33	TIP33A	0.63	2SC1923	0.30
BYX71/600	1.18	TIP34A	0.72	2SC1945	2.88
BYZ12	0.42	TIP41C	0.46	2SC1953	0.74
C106D	0.80	TIP42A	0.52	2SC1957	0.76
E1222	0.40	TIP47	0.60	2SC1969	2.88
E5024	0.30	TIP110	0.88	2SC2028	0.73
GET872	0.48	TIP2955	0.60	2SC2029	2.10
ITT44	0.04	TIP3055	0.60	2SC2078	1.05
ITT2002	0.11	TIS43	0.32	2SC2091	0.73
ME0402	0.20	TIS88	0.40	2SC2098	2.90
ME0404/2	0.24	TIS90	0.25	2SC2122A	3.20
MEU21	0.60	TIS91	0.28	2SC2166	1.20
MJ400	1.25	ZTX108	0.12	2SC2314	0.80
MJ2955	0.90	ZTX109	0.12	2SC2335	1.50
MJ3000	1.98	ZTX212	0.28	2SC2371	0.90
MJE240	0.60	IN4001	0.05	2SC2749	2.70
MJE340	0.54	IN4003	0.05	2SC2752	0.60
MJE370	0.88	IN4004	0.06	2SD234	0.64
MJE520	0.48	IN4006	0.07	2SD348	3.30
MJE2955	0.99	IN4007	0.07	2SD986	0.62
MJE3055	0.70	IN4148	0.05	2SJ50	5.20
MPSLO1	0.28	IN5400	0.12	2SK134	3.80
MRF475	2.50	IN5402	0.15	2SK135	4.60
MRF479	5.20	IN5405	0.16	3N126	1.90
MRP477	10.00	IN5406	0.18	3N211	2.52
OA47	0.10	IN5408	0.20	3SK45	0.76
OA90	0.08	IS920	0.08	3SK88	0.66
OA91	0.09	2N697	0.55	3SK135	5.20
OA95	0.18	2N706A	0.33		
OA200	0.06	2N2904	0.28		
OA202	0.15	2N2906	0.24		
OC25	2.10	2N2926G	0.10		
OC26	1.70	2N3053	0.22		
OC28	1.50	2N3054	0.56		
OC29	2.47	2N3055	0.45		
OC35	1.75	2N3702	0.10		
OC36	1.75	2N3704	0.10		
OC42	0.72	2N3708	0.10		
OC42K	1.40	2N3772	1.90		
OC44	0.72	2N3773	2.70		
OC45	0.58	2N3904	0.16		
OC71	0.50	2N3906	0.16		
OC72	0.52	2N5294	0.48		
OC81	0.68	2N6107	0.71		
OC200	2.46	2N6126	0.68		
OC202	2.20	2SB337	1.60		
ORP12	0.85	2SC495	0.65		
R2008B	1.50	2SC1172Y	2.90		
R2010B	1.52	2SC1173Y	0.82		
SHG1.5	0.40	2SC1302	1.40		
TAG1/100	1.40	2SC1226	0.84		
TAG3/400	1.78	2SC1279	0.50		
TIC44	0.40	2SC1306	0.92		
TIC45	0.45	2SC1307	1.40		
TIC46	0.48	2SC1413A	2.70		
TIC47	0.70	2SC1444	1.45		

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22nF 300V AC	32p
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470nF1000V DC	60p

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Whatever happened to Prestel?

Well it's still going, just about, but has hardly made the impact the Post Office expected when it started the service five years ago. The original plan was for some 100,000 installations during the first year, with escalating growth thereafter. Had all gone well we might have seen say two million installations after five years. The actual figure is some 45,000. Whatever went wrong?

Prestel arrived at the time when Information Technology was considered to be the thing of the moment. We were entering an information orientated society. Or so some dreamers thought. We would soon have vast amounts of information at our fingertips and the availability of this information would change our way of life. You can make out a case for this. If you're in the market for a house or a car for example, wouldn't it be nice to dial up the details of what you want and can afford and have the relevant items on offer flashed on the screen before you? No more trudging between estate agents and car dealers.

Yes indeed, but how often do you buy a house or a car? Not all that frequently. So the expensive system sits there awaiting its occasional use. Ah, but then there's the weekly shopping, banking, and all that other information for one's use. Banking maybe. The dreary procession to the bank to then stand around in a slow-moving queue is something we could all do without. Except that the banks have already moved to change that, with their cash dispensers, credit cards and so on. Shopping? A failure of psychology here. Yes, it would be nice to go out armed with a list of keenest prices and special offers, but the idea was that you'd do it all by dialling from home. Shopping however is part of a way of life. A chance to get out and look around. Meet a few people and get up to date with the local gossip. The better retailers know all this and have put a lot of thought into shop layout and presentation, to their own benefit and it seems to the public's approval. I wouldn't care to say how many times over the years I've read articles suggesting that the end of department stores and Oxford Street is imminent. Yet people still flock to Oxford Street, stores are full, and it's likely that this will continue for many years to come. Shops may theoretically be a rather inefficient mode of goods distribution, and can be frustrating and time wasting. But to get in amongst the goods, to see and sample what you want, is more atuned to human needs than dialling up for a printout on the screen.

If what you're after is impartial guidance in the home, then *Which?* does a far better job. And here you have another point that was overlooked by the information technology enthusiasts. We were assured that the printed word would soon be a thing of the past. Information would be provided by computers rather than journalists, and would be dialled up instead of being typeset, printed and carted around in the form of great bundles of paper. How inefficient! Yet in practice the printed page is a far more appropriate means of presenting information than the TV screen. Just compare the amount of information you can get into a page with what you can get on to a TV screen. Then you can flick through a paper, magazine or book, which will hopefully be presented in a logical form to assist with the information seeking quest. You can go back to the bit you were unsure about – or the point where you fell asleep! If you buy a publication regularly you know what to expect and how to use it. Information held in a computer is a rather different matter. You've got to know exactly what you want at the outset, then you've got to know how the computer stores it, i.e. how to ask the computer for what you want. Prestel involves a rather laborious search system for getting the information out – always assuming that it's there to start with. And going through the procedure can be expensive and time consuming.

Which brings us to cost, another drawback with Prestel. The information and the equipment to get it don't exactly come cheap. So interesting the public in it involves the hard sell. The PO, more recently British Telecom, haven't been exactly successful here. But then the public is rightly suspicious of new ideas and services, and is generally conscious of prices and value for money. Information as a cold collection of facts is hard to sell. How do you convince the man in the high street that he's starved of information? How do you go about selling him a databank he doesn't understand let alone feel a need for?

The basic problem with Prestel has been its blunderbuss approach. Trying to sell to the public at large something as unspecific as "information" is hardly likely to be a success. It seems that Prestel has learnt this lesson and that the sales pitch will in future rely on selling specific information to identified markets – a recent example of this is the Farmlink service. But even here it will meet with strong competition from the established information providers – the specialist press, which has been a growth area of publishing in recent years. Back to the point that the printed page can do it better!

Prestel has been a failure as a mass information service, though there's reason to feel that it may have a viable future as a provider of specialised information. To overcome the problem of the cost of equipment – a classic chicken-and-egg situation – it might be better to have Prestel available in the high street for use when it's wanted, which for most people would not be very often. You could then go along to get the information you want when you want it. True this is not the armchair access concept that was fundamental to the original idea of viewdata. That might come later if and when the cost of the technology falls dramatically. What in fact went wrong with Prestel was that the idea and the technology arrived before its usefulness could be properly assessed.

COVER PHOTO

Our cover photo this month shows the Frowds Surveyor VI CCTV camera with the covers removed. The Surveyor VI is a versatile, fully weatherproofed camera with circuit refinements to maintain the performance over a wide range of lighting conditions. It's designed for continuous unattended operation in industrial or open-air environments. Our thanks to Frowds Ltd., 4 Northarbour Road, Cosham, Portsmouth, Hants PO6 4TJ.

VIDEO SERVICING

Mike Phelan's Video Servicing feature will be resumed next month.

PIN CONNECTIONS

The pin connections for the LM324 i.c. (Fig. 4, page 658) were omitted last month. Pin 4 is the supply input and pin 11 chassis. Gate one's connections are pin 1 output, 2 – input, 3 + input.

TEST PATTERN GENERATOR

We have been asked to make it clear that the cost of the set of preprogrammed EPROMS for the Test Pattern Generator project (May-September 1984) from JRW Developments is £29 inc. VAT – this is for the *four* 2532s, not three as stated in the article. This price will be held while stocks last. It may be necessary to increase the price at a later date.

Variable IF Sound Channel

Hugh Cocks

Satellite TV transmissions use a variety of frequencies for the associated sound channel, the sound subcarrier frequency varying between 5·5MHz and 7·5MHz (see Table 1). Since there's no standard frequency, reception calls for a tunable demodulator with high sensitivity – especially with the new 11GHz services. Good sensitivity is a must as the sound subcarrier that accompanies the f.m. video is generally transmitted at a reduced level: as often as not the whole transmission is weak, which can lead to buzzing and noise if the input preselection and gain are not all they could be.

Basic Design

The sound channel described in this article uses a TDA1190Z i.c. which in addition to the demodulator includes an audio amplifier. The advantage of this is a low component count. Other intercarrier sound i.c.s such as the TBA120 should work just as well with the same tuning and preselection arrangements. A Philips G8 chassis sound selectivity module is used for input tuning: it's still available cheaply and is simple to modify for external tuning with varicap diodes. The module can easily be mounted on the PCB that holds the demodulator i.c. As a bonus, the quadrature coil for the i.c. consists of a redundant coil removed from the module. The circuit can also be used as a 4·5MHz-6·5MHz terrestrial TV intercarrier sound channel with no problem. If reception of only part of the band is required, e.g. Gorizont 7MHz and 7·5MHz, or the 6·5-6·8MHz range, ordinary low-capacitance swing v.h.f. tuning diodes such as the BB103-BB109 series can be used. If the full band is required, h.f. tuning diodes such as the KV1235 must be used. These are available from Ambit International.

The Selectivity Module

The original circuit of the Philips U500 sound selectivity module is simple (see Fig. 1). The output from the video detector enters at pin 4 and is then split two ways, going to the base of the BF194 transistor (some units use equivalents) and via L3 to pin 5 (feed to the video processing chip in the G8). When used in the G8, the chroma signal is taken from the emitter of the transistor, via pin 8. L1, L2 and the associated components form a top-capacitance coupled bandpass tuned circuit for the sound signal which is tapped from the junction of C2, C3. A 12V supply is fed in at pin 2: pins 3, 6 and 7 are connected to chassis.

Since the chroma output is no longer required, the gain of the unit can be increased by decoupling the transistor's 560Ω emitter resistor. A 100pF decoupling capacitor, connected from pin 8 to chassis, seems to provide optimum results – a higher value causes buzzing on sound, probably due to the chip being overloaded. The capacitor can be fitted on the print side or, more elegantly, on the main board.

Coil L3 and its associated tuning capacitor are removed from the board. This leaves pin 5 free, which is useful for feeding in the tuning voltage. When 30 turns have been removed from L3 it can be used as the quadrature coil. Do this carefully, ensuring that there's a good soldered joint on the securing pin when the unwanted turns have been removed.

If the full range is required, using h.f. diodes, remove C1 and take eight turns off each side of the centre-tapped coil L1 (16 turns in all). Solder 0·0047μF (nominal) d.c. blocking capacitors to each side of the coil with a varicap diode between – see Fig. 2. The 100kΩ (nominal) d.c. feed resistors can go straight into the holes left by L3 and its associated capacitor. Ensure that the diode is inserted the right way round or very odd tuning effects will cause head scratching later. If only partial coverage is required, using v.h.f. diodes, leave C1 in circuit but remove the same number of turns from L1.

Remove 20 turns from L2 and change C2/3 to around 82pF each (leave at 270pF with a v.h.f. diode). Since one side of this coil is connected to chassis only a single feed resistor and blocking capacitor are required. The tuning feed for the diode used with this coil has to come a little way over, either from the same point as the resistor going to D1 or from the hole left by L3's tuning capacitor. Mount the resistor by the diode and run a wire over to the d.c. input point.

The tuning diodes can be tucked in neatly by the coils so that the original can just fits over – if you can get one (most have long gone unfortunately). Be very careful not to short anything out. When removing the coils for modification be careful not to peel the print – this is easily done. When resoldering, ensure coil d.c. continuity at the print itself to avoid problems later. Also double check that the d.c. feed resistors are of high value (100kΩ or more) as odd effects will occur if the tuned circuits are accidentally damped by using a low-value resistor. The modules themselves are reliable. The worst problem is hairline cracks at points of most mechanical stress. On one occasion a noisy transistor had to be replaced.

Table 1: Satellite sound subcarrier frequencies.

Gorizont (Russia) 7MHz, 7·5MHz.
US Forces TV 6·8MHz (low-deviation radio channel around 6MHz).
TV5 (France) 6·6MHz (wide deviation).
RAI (Italy) 6·6MHz.
Teleclub (Switzerland) 6·5MHz, 5·5MHz (unused at present).
Intelsat services 6·6MHz, 6·65MHz.
Argentina 6·3MHz.
Libya 6·2MHz.
Spain 6·6MHz, 6·65 MHz.

Demodulator/AF Circuit

The demodulator/a.f. circuit is conventional, see Fig. 3. Be careful with the layout if using Veroboard etc. as instability may arise. Ensure that after modification the quadrature coil has d.c. continuity or weak hissing will be noted at low volume settings – with everything cutting out at normal levels! The Philips quadrature coil is best glued to the board vertically, with short leads (use resistor offcuts) taking the connections through. There's provision

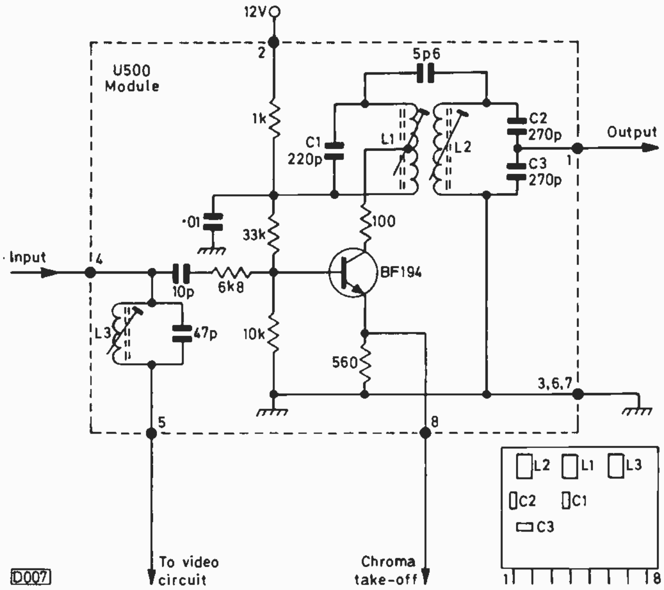

Fig. 1: Circuit of the U500 sound selectivity module.

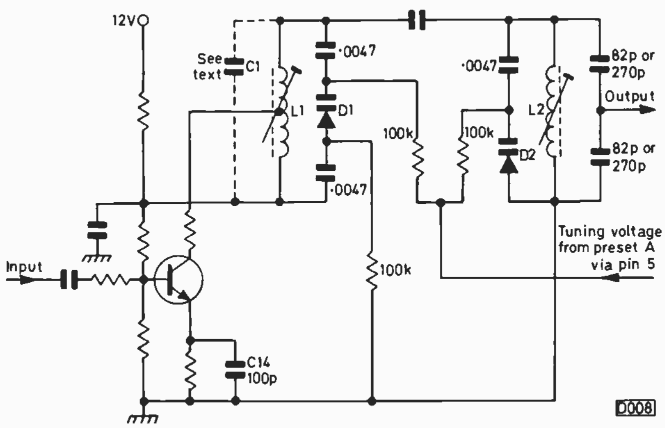

Fig. 2: Selectivity module after modification.

on the board (Fig. 4) for the coil to lie horizontally, but this makes access to the core difficult. The speaker coupling capacitor C4 can give rise to instability at highish

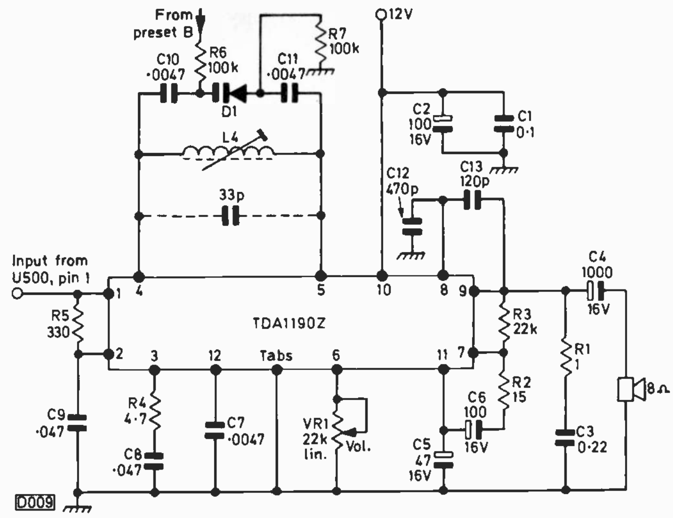

Fig. 3: Demodulator and a.f. circuit.

volume (screeching). C3 in the Zobel network across the speaker can do similar things – without this network virtually nothing occurs apart from low-level buzzing.

There's no damping resistor across the quadrature coil as the audio seems to be better without one, probably due to the Q being lowered a little by the diode. If the audio is a little distorted or a diode is not going to be used (fixed tuning) a damping resistor can be added. Start with 10kΩ and reduce the value till distortion is no longer heard. Add a 33pF tuning capacitor when using a v.h.f. diode.

The resistors are all 0·25W types. Note that with some i.c.s there's weak sound at minimum setting of the volume control and that volume increase is very sudden when the control is advanced. Top and bottom presets may be a good idea here. If a u.h.f. modulator or TV monitor that requires a low-level input is to be used, turn the volume control setting down a little.

The PCB has space for four presets to enable two sound channels to be switched by means of a front-panel mounted rotary switch (see Fig. 5). Modification for continuous tuning is simple. Don't link A to B, and solder in only two presets, one for quad coil tuning and the other

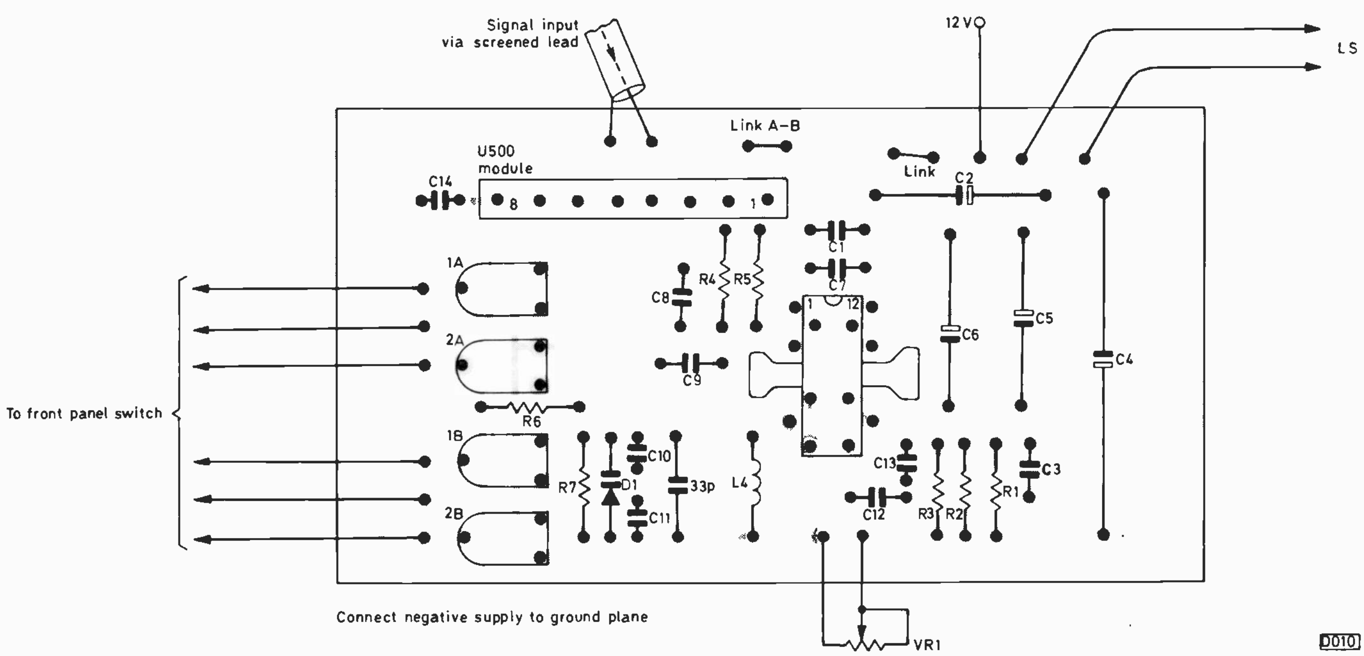

Fig. 4: Component layout. The components are mounted on the groundplane side of the board. Board actual size.

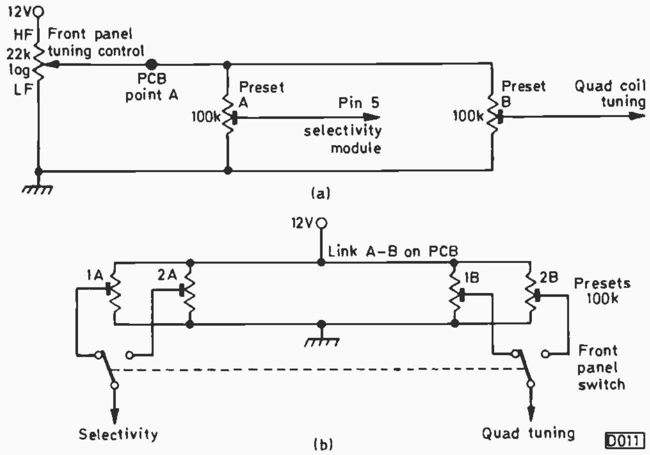

Fig. 5: Alternative tuning arrangements. (a) For continuous tuning, (b) for two-position switched tuning.

for selectivity. Wire the outputs into the tuning voltage inputs. Use a front panel potentiometer for tuning – link the 12V supply to this and take the slider back to point A on the board. The presets then serve for tracking.

Testing and Setting Up

Before trying the unit out, check that the tuning voltage is reaching the diodes and that they have been inserted the right way round. Turn up the volume and check that a good hiss is obtained without squegging/instability at high volume. If this is heard check the components previously mentioned. Tuning across the band will probably produce some noise variation. In the absence of a signal generator or satellite signal, connect a 6MHz UK sound TV signal and see that the tuned circuits peak up well.

To some extent the setting of L2 is not critical. The diode appears to make a difference only at the top end of the band, above 7MHz. Indeed a low-swing v.h.f. type can sometimes be better. The h.f. types are sold in blocks of three however, so it may be best to experiment. Tuning below the 6MHz UK signal will reveal the PAL subcarrier at 4·43MHz as a distinct buzz at one point. The voltage required to go from 4·5MHz to 7·5MHz is rarely more than 4-9V, so limiting presets in series with the tuning potentiometer may be useful.

To set up on Gorizont, ensure a "smooth" transition from the 7MHz TV sound channel to the 7·5MHz radio channel with no background from the unwanted subcarrier. With BB103s used to tune from 7MHz to 7·5MHz the action of the quadrature coil diode will be very sharp with only a small voltage change, but the preselection diodes will require virtually the full 0-12V swing, so set the 7MHz preselection preset to zero volts and peak L2 and L1, then adjust the 7·5MHz preset for best signal, again with no background from the 7MHz channel (easy to get with the tracking slightly off). Note that the Gorizont audio always sounds slightly distorted due to the pilot tone compression system used (for an expansion circuit, see Nick Harrold's article in the December 1983 issue).

The 6·5-6·8MHz subcarriers from other satellites are easily tuned in and there's no compression to worry about. Indeed one service promises stereo sound using a multiplex system by the time this is read. The unit should be highly sensitive with 4·5MHz (ever hopeful in the UK!), 5·5MHz and 6·5MHz terrestrial DX signals.

The board can be installed in the TV set, taking the place of the existing sound circuits. Ensure that the feed to the old circuit is removed or some loading may occur at 6MHz, causing loss of sensitivity.

On very marginal signals the use of a phase-locked loop detector circuit can be an advantage (see page 85, December 1983) – it can be preceded by the modified selectivity module – though one has to say that the difference is not very great in practice unless the deviation is restricted (as can happen with certain American signals). In this case the quadrature circuit will produce a lot more noise.

Component Sources

The KV1235 varicap diodes are described as "triple a.m. tuning" types and are available (order code 12-12355) from Ambit International, 200 N. Service Road, Brentford, Essex CM14 4SG at £2·75 plus VAT for three. Range is 30-450pF from 8-2V. Check the cathode/anode connections with a meter – the body indication is vague. Sendz have a good stock of the obsolete BB103 type (cathodes banded). The BB109 type (15-42pF nominal) is available from Ambit (order code 12-01095) at 27p each plus VAT (cathodes banded). U500 selectivity modules are available from Manor Supplies (probably without can) at about £3 each tested. Ready etched boards can be supplied by Hugh Cocks TV Services, Cripps Corner, Robertsbridge, Sussex. Made up units may be available.

My thanks to Dave Lewis for his assistance with the experimentation and in developing the unit.

CRT Tester/Booster

Jim Littler

This simple unit was designed to test and reactivate tubes. It's cheap to make and simple to use. The mains transformer was taken from a scrap Decca Bradford chassis.

In the test position the grid and cathode of the gun being checked are connected to chassis while some 60V is applied to the first anode. The meter (0·5 or 1mA f.s.d.) indicates the current flow, which for a good gun should be about 100μA.

In the reactivate mode h.t. is applied to the relevant grid while the cathode is connected to chassis. The current flowing via the cathode-grid "diode" will light the pygmy bulb L1 (240V, 15W). When the "diode" conducts, the dead coating is stripped from the cathode. As a result cathode emission is increased – this can be confirmed by switching to the test position. Never reactivate for more than five seconds. Don't try a second reactivation or the tube could die a violent death.

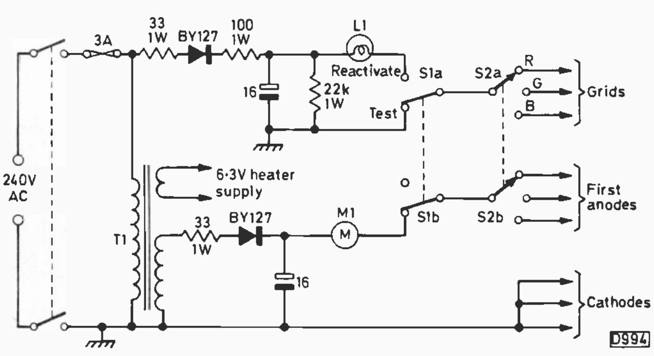

Fig. 1: C.R.T. tester/booster circuit.

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EHT Lead & Cap for Split Diode Lopt	90p
Anode Cap	47p
Sanyo Anode Cap Assy + Lead, 12TCD-CT-1G	65p
Degause Thermistors, PT37P, ITT/GEC	35p
Degause VDR E299D/HP230 3000/8000	25p
Casters Set of 4	1.90
Double Fuse Holder on Small Pax Board 20mm type	10p
Single Fuse Holder on Small Pax Board 20mm type	5p
Direct Panel Mounting 20mm Fuse Clips	(pair) 15p
Single Fuse Holder on Small Pax Board. As per early 3000 mains input	6p
EHT Cable	Metre 25p
13A Plugs	12 for 4.80
BF259 with Heatsink	14p
TIP110 with Heatsink	40p
L129/130/131 Coil	10p
6MHz Ceramic Filter	25p
DL700 (Philips) Chroma Delay Line	1.00
DL50 Chroma Delay Line	1.00
T9006A Lum Delay Line	1.00
8K5/9K Lum. Delay Line	65p
Plastic Cover for 3K5 SP8385	5p
TX9 Back Ground Control 10K	15p
TX9 Gain Control 100R	15p
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Thorn 8K5 Focus Pot	2.40
Thorn 4000 Focus Pot	2.75
Thorn 18Ω 9W (3K5) R752	30p

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Ambersil MS4 Silicone Grease	12oz	2.15
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Ambersil Amberlube	6oz	1.89
Ambersil Ambertron	16oz	1.95
Ambersil Anti-Static Screen Cleaner	7oz	1.95
Ambersil 40+ Protective Lubricant	14.1oz	2.15
Ambersil Amberclens Foaming Cleaner	13oz	1.26
Ambersil Circuit Lacquer	14oz	2.15

THICK FILM RESISTOR UNITS

3500 Thorn (5 Pin Connection) video	1.70
4000 Thorn (4 Pin Connection)	1.90
725/731 Pye (6 Pin Connection)	2.20
713 Pye (6 Pin Connection)	2.20

FUSES

20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
315MA A/S	10 for 50p	750MA	10 for 65p
500MA	10 for 50p	7A	10 for 50p
1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn S.O.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9600	12.00
Thorn LOPT 1615	7.25
Thorn LOPT 1590/91	7.25
Thorn LOPT 1690/91	7.25
Thorn LOPT 8000	9.80
Thorn LOPT 8500	9.80
Thorn LOPT TX9	9.85
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 731	10.18
Philips LOPT G9	8.80
Philips LOPT G11	13.75
GEC LOPT 3113	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM-WM-21	6.75
Sanyo LOPT AM-WM-4	7.30
Philips LOPT G8	7.80
Sanyo LOPT (CW21) 4-2751-44700	5.00
ITT LOPT CVC5-9	9.60
ITT LOPT CVC30	8.75
ITT LOPT CVC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Korting AZ9100	10.25
Korting B92-170	10.25
Korting AZ2101	10.25
Korting AZ2103	10.25
Korting ZTR1001	10.25
Siemens V1155	11.75
Siemens V1823	11.75
Zanussi BS2222	10.25
Zanussi BS2223	10.25
Salora FR0057	10.25
Salora FR0029	10.25

300 Mixed Resistors	1.50	10 Spark Gaps	1.00
300 Mixed Capacitors	1.50	10–16 pin Quil IC Socket	90p
150 Mixed Electrolytics	2.00	20 Assorted TV Knobs	1.00
100 W/W Resistors	1.00	10–16 pin Quil to Dil IC Socket	90p
20 Mixed Conv Pots	1.00	100 Mixed Diodes	1.00
40 Mixed Pots	1.50	50 Mixed Mica Washers	65p
20 Mixed Sliders	1.00	300 Mixed Resistors & Capacitors	1.50
40 Mixed Presets	60p	10–16 pin Dil to Dil IC Socket	1.00
20 Mixed VDR & Thermistors	1.00	50 Electrolytics & 50 Capacitors	1.00
20 Mixed Ferrite Cores	50p	50 Mixed Poly Capacitors	1.00
100 Mixed Ceramic Discs	1.00	30 Mixed Neons & Bulbs	1.00
20 Mixed Valve Bases	1.00		

						BF167	24	BFR62	28	NKT276	20
						BF173	29	BFR81	29	NKT453	1.65
AC128	39	BC172	9	BC559	8	BF179	32	BFR87	25	OT112	1.92
AC131	40	BC174B	23	BC595	8	BF180	33	BFR90	1.74	OT121	2.08
AC138	40	BC177	24	BCX33	22	BF181	30	BFR91	2.08	R1038	80
AC141K	39	BC182LB	12	BCX34	11	BF184	30	BFT42	30	R1039	80
AC142K	38	BC183L	12	BD115	49	BF185	30	BFT43	30	R2008B	1.40
AC153	39	BC184L	13	BD131	30	BF194	16	BFX38	40	R2010B	1.10
AC176	33	BC187	24	BD132	46	BF195	16	BFY50	30	R2030	70
AC176K/		BC204	15	BD133	59	BF196	16	BFY51	34	R2265	1.30
AC128K	93	BC208	9	BD139	36	BF197	15	BFY52	34	R2305	80
AC188	38	BC212L	9	BD140	38	BF198	19	BRC116	1.50	R2322	50
AD142	1.18	BC213L	12	BD144	1.70	BF199	15	BRC1693	1.43	R2443	25
AD143	1.08	BC237	12	BD150	50	BF223	18	BU105	1.00	RCA16446	30
AD149	98	BC238B	8	BD163	98	BF224	19	BU126	1.10	RCA16599	1.25
AD161	32	BC238L	8	BD201	74	BF238	20	BU207	1.05	RCA16600	1.40
AD162	32	BC250A	15	BD203	78	BF240	9	BU208	1.15	RCA16799	1.13
AD263	1.05	BC251	8	BD204	99	BF241	21	BU208A	1.15	RCA16800	1.42
AF127	45	BC252A	20	BD222	48	BF255	10	BU326A	1.30	RCA16802	1.38
AF139	38	BC294	37	BD225	52	BF256S	20	BU407	1.70	S1299	2.25
AF239	41	BC301	32	BD232	50	BF257	28	BU408	2.76	S28000	1.25
BC107	15	BC303	31	BD233	60	BF259	28	BU500	2.30	S6080A/B	3.50
BC108	15	BC307	10	BD234	60	BF271	25	BU526	2.46	T6050V	1.30
BC109	15	BC308	8	BD237	55	BF274	11	BU807	2.94	T6052V	1.30
BC115	16	BC309	14	BD238	65	BF337	29	C1129	9	T9003V	1.25
BC117	21	BC327	18	BD241	59	BF338	34	C1172B	9	T9010V	1.45
BC125	26	BC328	18	BD244	85	BF355	40	E5386	54	T9053V	1.30
BC126	23	BC337	17	BD278A	81	BF362	50	E9003	28	T9054V	1.00
BC139	27	BC338	17	BD386	68	BF391	21	E9005	25	T9039V	1.10
BC141	34	BC347	8	BD433	71	BF394	16	ME0404	10	TIC45X	50
BC142	30	BC394	8	BD437	83	BF422	47	ME0412	10	TIC46	48
BC143	31	BC454	8	BD592	1.20	BF423	53	ME6002	10	TIC106C	40
BC147	12	BC455	8	BD589	1.20	BF450	43	MJ2501	2.36	TIP29	42
BC148	12	BC456	10	BD677G	1.35	BF453	53	MJ3001	2.21	TIP30	42
BC149	12	BC460	40	BD707	95	BF458	37	MJE182	47	TIP31	35
BC153	16	BC463	22	BD708	95	BF459	40	MJE340	50	TIP32	43
BC1540R	16	BC546	8	BDX10	93	BF461	59	MJE520	50	TIP33	61
BC154YL	16	BC547	12	BDY20	1.09	BF556B	35	MJE2955	1.40	TIP41	42
BC157	12	BC548	12	BDY82	99	BF596	15	MJE3055	1.50	TIP42	45
BC158	12	BC549	8	BF137	20	BF694	16	NKT241W	8	TIP110	61
BC159	15	BC557	10	BF153	20	BF757	62	NKT241G	8	TIS91	25
BC171	9	BC558	10	BF154	25	BFR52	31	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2002	2.80
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2030	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2522	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2530	2.61
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2540	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2560	3.50
LM1303P	1.48	SN76226N	1.25	TBA720A	2.49	TDA2581	3.00
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2591	1.96
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2611A	1.95
ML239B	2.86	SN76622N	1.00	TBA810S	1.00	TDA2640	2.90
MC1327AP	1.25	SN76660N	80p	TBA810AS	1.00	TDA2690A	1.50
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA3560	6.00
MC1455P	18p	SN76744	1.92	TBA950	1.95	TDA9503	2.90
MC14516BCP	60p	TA7117P	1.00	TBA1440	1.92	TCEP100	3.48
SAA1025	7.20	TA7109AP	2.80	TCA270SA	1.05	TEA1009	1.95
SAA1124	4.50	TAA611	1.40	TCA270C	1.05	MC14426P	4.80
SAA5010	6.00	TBA120B	1.20	TCA270CQ	1.05	MC14429P	4.50
SL432A	1.80	TBA120C	1.20	TDA1004A	4.00	MC14514	5.00
SL1430	2.50	TBA120CQ	70p	TDA1035T	3.50	UA758PC	2.50
SN15846N	60p	TBA120S	70p	TDA1037	2.72	UA1008A	2.66
SN74123N	65p	TBA120U	1.00	TDA11705	1.50	ULN2165	1.30
SN74154N	1.40	TBA395	1.00	TDA1200	2.42	ULN2216A	1.25
SN76001N	1.40	TBA480Q	1.40	TDA1270	2.76	UPC1365C	5.75
SN76110N	1.14	TBA510	1.90	TDA1327	2.53	SC9488P	1.40
						SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 new boxed	5.00
Thorn 4000 Convergence panel ex-factory	3.75

Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1,75
Thorn 3K5 PSU bottom board PC206 new	2.75
Thorn 3K5 IF panel new	3.00
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable	50p	Coax Plugs	10 for 1.65
Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	2.50	Band Change Switch Assy, Pye 725	40p
Line Connectors	38p	Flush Mounting TV/FM Diplexer	1.00
		Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 350+20+148+1K5+317	1.40
Thorn 6+1+100	92p
Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

100+150+150	350V	50p
220+47	350V	65p
200+150+50	350V	60p
200+200+100	325V	54p
32+32+16	275V	52p
200+200+100+32	350V	70p
100+50+150	350V	58p
400+400	200V	72p
32+32+16	350V	52p
200+32+300+100	350V	70p
225+25	350V	50p
200+200+100	350V	70p
200+100	325V	65p
200+100+100+50	350V	60p
200+200+100	350V	55p
200+200+75+25	350V	60p
50+50+8	300V	55p
100+50+100	350V	55p
100+150+50	350V	55p
2500+2500 (Thorn 8K)	63V	1.20
150+150+100	300V	1.80
200+47	250V	65p
500+500	175V Thorn TX9	1.00
175+100+100	350V Thorn 3K5	2.25
400	400V Thorn 9K	2.50
470	250V Philips G11	1.50

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 70V Thorn 3K	1.00
50MF 275V	50p	1500MF 100V	1.05
100MF 150V	65p	2000MF 30V	50p
100MF 250V	70p	2200MF 40V Thorn 4K	95p
100MF 450V	75p	2200MF 63V Philips G9	1.25
220MF 400V Thorn 9K	1.30	2500MF 35V	65p
220MF 450V Thorn 4K	1.30	2500MF 40V	65p
400MF 350V Thorn 8K	1.00	3000MF 30V	65p
800MF 250V Print type	80p	3300MF 16V	50p
800MF 250V	70p	3300MF 25V	60p
		4700MF 16V	72p
		4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC8 On/Off Switch	65p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2·5A Push to make on/off switch	15p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
BT116	1.00	IN5400	12p
BT119	2.56	IN5401	12p
BT120	2.82	IN5402	14p
BT151 650	1.00	IN5404	12p
BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BY223	95p	SKE1/02	20p
BY225	1.20	MCR106/1	1.00
BY227	28p	MCR406	35p
BY298	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/600	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	OA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BY255	30p

Grundig's VHS Machine – Model VS200

Steve Beeching, T. Eng.

At last we have a truly European VHS machine, not one designed in Japan or built from a Japanese kit of parts. It's typically Grundig and looks like their 2080 V2000-format machine – in fact it appears to be a VHS machine built into a V2000 chassis. The systems control and power supply arrangements are thoroughbred Grundig designs developed from the previous machines. The new sections, new to Grundig that is but familiar to many of us, are the VHS parts, but even these are more characteristic of Grundig than the Nipponese.

It was strange to see the V2000 machine's tape transport system with its U-wrap mechanics re-engineered to the VHS tape track standard. A new set of i.c.s has been developed by Grundig and Mullard. These are as follows: TDA3750 colour a.f.c. and phase-locked loop; TDA3760 VHS colour record/playback processor; TDA3771 video signal switching and level clamping; TDA3780 VHS f.m. modulator.

Tuning is similar to that used with current Grundig TV sets – auto search and store or select the programme number and punch in the u.h.f. channel number. So that programmes can be monitored, the machine will produce E–E pictures without going into record. This is done by using the programme plus and minus buttons and then manually stepping through the channels. But you can't then go into record without first cancelling E–E with the stop button followed by "programme number select" and then "record", record starting when output monitoring returns. Not difficult to cope with, but a curious arrangement nonetheless.

One very nice facility is the ultra-long life power source (which I haven't found yet) that enables you to unpack the machine, fit a plug and switch it on to find that the clock and date are set correctly. The date is set as part of the programmable timer which allows for seven programmes over a year. My God! 365 Crossroads!

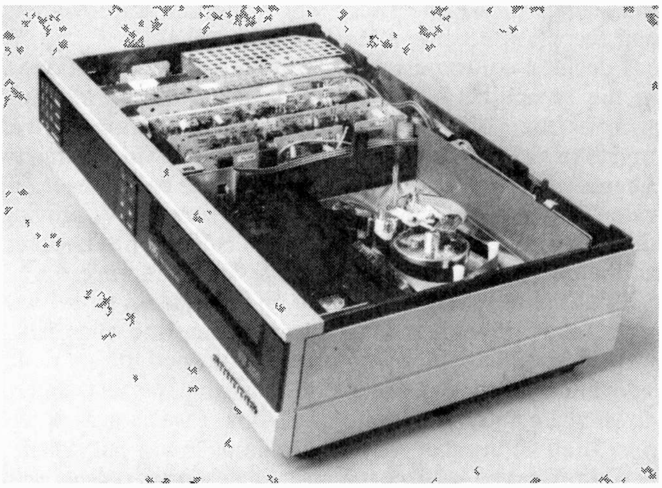
An interesting feature is the EPROM. Early versions are designated E42. Later ones are designated E43 and contain a whole host of extra service codings. The primary coding, 8500, enables the customer to lock the machine with a four digit number. The machine won't operate until that number is re-entered, unless you know the way to overcome it . . . no tales! Andy reckons that the kids will be punching all sorts of numbers in so that their parents can't watch their video nasties and we'll have to cancel the codes. It could bring in a nice little income that could. Other 8500 codes allow for continuous playback or recording and various special servicing features. 8508 for example inhibits all safety functions, so that if say a microswitch or end sensor is playing up operation can be continued during fault finding. I'm not sure about a keyboard fault though.

The picture quality is fairly good, certainly acceptable enough for me to be able to record and replay programmes without being aware of visual impairment. On a test pattern, a static picture or a picture with hard contrast detail, such as bare tree branches against a light sky, you may find that there's excessive detail correction. There's an internal correction adjustment for "best visible response". The problem is what's the best setting? Sets with soft tubes will want a sharper response: others, like my 40in. Cinema 9050 unit, will require less. It would have been better to have had a preset sharpness control at the rear rather than an internal preset.

These comments are not based on a single machine. We've had several, and some points have been taken up with Grundig. When we recorded a test tape on a centre tolerance JVC HR7200 we found that the colour frequency was off by about 150Hz. The Grundig machines wouldn't replay it in colour while other VHS machines would. I think the heads are incorrect on one machine: certain prerecorded tapes play back with black speckles on peak white edges and the machine will not clear the picture noise on still frame – a similar problem occurred with the first batches of HR7650s and their Ferguson equivalents. Another machine is excellent, with no speckles and perfect still frame. There's no jitter on either of these machines.

The VS200 will assemble edit all recordings. This is a very neat function. If a series of timed recordings is made the replay is free of any disturbances at the joints. A fellow reviewer commented on a time delay with the audio muting when an edit occurs, but there's no break on the actual recording, only on the E–E monitoring. An investigation revealed that this is due to the series of operations that occur when record start is selected. The tape threads up, rewinds slightly, then plays so that the new and already recorded signals are phased. The machine finally goes into record to give a beautiful edit. This takes ten–twelve seconds, during which the E–E audio is muted. It's not a significant problem and you can be sure that the signal is being recorded about ten seconds after you give the order.

I certainly like this Grundig VHS machine. The teething problems are doubtless due to early production problems. Versions with stereo and VHS hi-fi sound are expected to follow. I hope that Grundig and Mullard will develop frequency interleaving between tracks to reduce noise: less edge emphasis will then be needed, with edge noise reduced to the level found on current JVC machines.



Inside Grundig's first VHS machine, Model VS200, which was produced from the drawing board in just seven months and is of more than 95 per cent European origin. The recommended retail price is £459.

The Tangled Web

Les Lawry-Johns

We'd known Mr. Spyder for a number of years and had always been on good terms with him. So when he popped in with his daughter's rather old monochrome portable we had no hesitation about accepting it for repair, even though it was a Thorn 1580 with valves and things in it.

"It goes all right for about half an hour, then funny things happen. Sort of goes into oscillation if you know what I mean."

So he left it with me and the hours of frustration started. Work on it till something else demands attention, put it on one side and go back to it later. This dragged on all over the weekend. The complicated colour sets that came in were repaired in no time with no bother worth mentioning. A new line output transformer here, a new tripler there, a replacement bridge rectifier, new tuner selectors – all run of the mill jobs that any fool could do. But that little portable had me by the short and curlies. Maybe it was because I've not been feeling too well lately and my mind's a bit cloudy. So on I blundered. As Mr. Spyder said, it went into oscillation after half an hour, first showing a very noisy picture.

My diagnosis was that the fault was in either the tuner or the a.g.c. circuit. I plugged in a spare tuner but the oscillation proceeded apace. So I checked the voltage at the collector of the a.g.c. transistor VT8. It was nearly 2V instead of 0·5V. All the associated components were checked and the main suspects changed, including the transistor itself. Something stirred in my mind. The transistor is gated on during the line flyback periods by pulses from the line output transformer. So I went over to the other side to ensure that the transformer's pulse winding (tags B and C) and its connections were intact and good. They were. Back to the i.f. strip.

The voltages around the i.f. transistors were correct but I changed the transistors just in case. I checked the decoupling, using a 33μF electrolytic and an 0·01μF capacitor as appropriate. All the capacitors were in order. In a fit of temper I decoupled the collector of the first i.f. transistor to chassis with the 33μF electrolytic, expecting the signals to vanish. There was a marked improvement and reception became almost normal!

I decided not to pursue this red herring and put it down to the capacitor's inductance. The a.g.c. transistor's base samples the voltage at the emitter of the video driver transistor VT5. Maybe the fault lay in the video circuits. There was a heavy negative voltage at the collector of the video output transistor VT6 instead of some 85V, proving that the whole thing was in a state of oscillation. I checked all the decoupling but nothing made any difference.

I put the chassis the right way up and looked at it. I was aware that something simple was eluding me and that I was too stupid to put my finger on it. I turned the set on its side once more and the picture became perfect. Put it down again and it burst into oscillation. I was amazed. Up, o.k. Then all buggery let loose again as it was put down.

A little voice said check the a.g.c. gating pulses right back to source. I looked at the small figure of E.T. He was pointing his finger at me as usual. So I plodded back across the panel from the pulse coupling/a.g.c. capacitor C55 to the source of the pulses, a potential divider across the transformer's pulse winding. The resistors checked o.k. individually, but the reading across all three was high when it should have been low, i.e. the d.c. resistance of the pulse winding. But I'd already checked the winding which was in order. At last the penny dropped and I stared at the connecting leads, each in its Sistoflex sleeving. The sleeves are fitted to ward off the heat from the PL81 and PY81 valves, but the wire inside had burnt through and made only when the set was cold – or when it was turned on its side, sometimes.

A new lead dressed well away from the valves completed a very simple repair and left me feeling guilty. Why? Because of the severe line pulling that had accompanied the oscillation. This should have lead to an early check on the reference pulses at source since they are also used in the flywheel line sync circuit. I'd put this down to severe video oscillation distorting the sync pulses. Live and learn.

When Mr. Spyder came back for the set he laughed as I told him what a headache it had been. "Just a little thing like that" he said.

"Clear off" I said, or words to that effect.

Another Headache

Now you wouldn't think that a Decca Bradford (30 series) could give one a nasty turn. Normally they're no sooner in than out again. A shorted boost capacitor here, a faulty sound output stage there, no real trouble. Not until Mrs. Footrot arrived that is. Her son carried in the 22in. Bradford and didn't say a word. Mrs. Footrot made up for his silence.

"You put a new tube in this set three years ago. Here's the guarantee card showing that it still has another year to run. I'll leave it here until Saturday, so please give me a chit to say that you have it. You can't trust anyone these days." She rabbited on in a similar vein for quite some time before I could get a word in.

"What's wrong with the set please, Mrs. Footrot?"

"Oh yes, the colours are funny and keep changing. It's like watching disco lights."

So they departed and I took a look at the disco lights. It frightened me. At first only the corners flashed their impurity at me, then the centre joined in with an odd pulsing effect, the colours continuously changing. I pulled the green and blue drive leads off to leave the red display on its own. The screen showed a patch of red in the centre changing to green and blue while the outside corners were pulsing all three colours.

"Degaussing" I thought and showed it to Honey Bunch. She said she'd never seen anything like it in her life and I had to confess that I hadn't either.

"What does that?" she asked.

"The degaussing coils are being charged and discharged at a rapid rate when they shouldn't be" I explained weakly. H.B. trotted off to feed the bird and change his (her?) water, leaving me to check the degaussing components carefully.

They were all in order. I unplugged the feed to the degaussing circuit from the on/off switch. The display continued apace. It was as if a dozen powerful magnets were being constantly moved about in front of the tube. I took the shield, coils and degaussing components complete from another set and fitted the lot in Mrs. Footrot's set. Still the same and I now knew what the trouble was, though I didn't like to admit it. So I replaced the scan coils and the purity magnets. Still the same, confirming that the tube would have to be replaced. This restored normal operation. What the hell was going on inside that tube to make it produce such a display? Does anyone know?

Teletopics

CED FADE OUT

The CED video disc system, which was launched in the UK by RCA, Hitachi and GEC in October 1983, is being phased out. The original plan was to sell 25,000 machines during the 1983 pre-Christmas selling period and a further 100,000 machines this year but in the event only some 5,000 have been sold. The 40,000 players held in stock by Hitachi are to be sold off at £99 each, with 20 free discs. Discs will continue to be sold as long as stocks last – the present catalogue lists 250 titles.

RCA are reported to have made a loss of $580 million on the CED disc system. Some 700,000 players have been sold in the USA since the system was launched there in 1981. RCA have announced that they will continue to manufacture discs for the US market for at least three years or as long as there is sufficient demand.

DBS PROGRESS

A report to the Home Secretary by the DBS consortium (the BBC, the ITV companies and five non-broadcasting companies) says that considerable progress has been made with plans to launch the UK's DBS service. Agreement has been reached on making £350,000 available for the project's next stage, and a business plan has been drawn up. This envisages a profit of £300 million over a ten-year period after substantial losses initially (£320 million during the first four years). One assumption made is that viewers would be prepared to pay £20 a month, to include the cost of the receiving equipment, for three DBS channels. A more pessimistic projection suggests that the service would still find it hard to make a profit after fifteen years.

RTEEB EXAMINATION CHANGES

Two new practical tests, at Part III level of Course 224 (Electronics Servicing), have been announced by the Radio, Television and Electronics Examinations Board. The tests are on VCR and colour television servicing.

TAKE-OVER BID FOR FIDELITY

An agreed bid for Fidelity Radio, valuing the company at £14·1 million, has been made by Caparo Industries which had built up a 32·4 per cent stake in the company in recent months. Caparo Industries is a diversified engineering group headed by Mr. Swraj Paul who says that the aim in taking over Fidelity would be to get his group into "slightly higher technology". A counter bid was considered by Amstrad but was dropped on the grounds that the companies have similar product ranges and the same customer base. Since the Amstrad factory at Shoeburyness is at present being expanded the company is not interested in acquiring Fidelity's manufacturing capacity. Amstrad's chairman Alan Sugar commented that Fidelity would be "a bargain at the price Caparo is offering". Fidelity had a difficult time during its last financial year, due mainly to problems with test specifications for its cordless telephones and a difficulty with its new CTV chassis (a timebase i.c. that has been designed in failed to perform to specification initially).

MARKET BLUES

The VCR, TV and other consumer electronics markets have been distinctly weak in recent months. VCR sales/rentals for 1984 are expected to end up at around 1·55 million compared to the level of 2·2 million reached in both 1982 and 1983. CTV sales/rentals are expected to be roughly the same as in 1983, though a peak was reached in the early months of the year. The situation is highlighted by comments made at the Thorn-EMI plc Annual General Meeting by Chairman and Chief Executive Peter Laister. For Ferguson, sales of TV sets and VCRs have so far been "substantially lower" this year than last. Thorn's rental operations have fared rather better however. Thorn claim to have 25 per cent more subscribers per outlet than any of the competition in the rental field and are maintaining CTV subscribers overall. In fact Thorn claim to be increasing their share of both the TV and VCR rental market. Peter Laister's comments on "new opportunities such as cable and satellite" are interesting. "In such cases we will invest to the extent of marking our position in their future, but will place limits on our short-term costs."

PHILIPS' TV MILESTONE

Philips, the world's largest TV manufacturer, has now produced over one hundred million TV sets – that doesn't include those produced during the pre-war period! To mark the event, simultaneous presentations of 100 sets each were made at Eindhoven and in London. The Dutch sets were presented to Princess Margriet for use by the Red Cross while the UK sets were presented to the National Society for the Prevention of Cruelty to Children which is celebrating its centenary this year. Philips' Electronics UK chairman Anton Poot commented that it took 35 years for Philips to produce its first 100 million sets but that the second 100 million should be produced in under ten years – "every three seconds day and night a Philips set is sold somewhere in the world".

TV DODGER CAMPAIGN

The Home Office has started a new campaign to catch TV licence dodgers. A fleet of 22 new vans, each costing more than £20,000 and ten times more sensitive than previous ones, will tour cities and major towns. Other elements in the campaign are computerised records that show unlicenced households, an increased maximum fine and a TV commercial.

TELETEXT ADVANCES

According to research carried out by the ITV teletext service Oracle more than two million homes in the UK now have sets equipped for teletext reception. This represents a market penetration of ten per cent. Market penetration is highest in the London area, at 22 per cent, and in the socio-economic class AB, at 27 per cent, though the greatest growth at present is "down-market". Oracle's research is being continued and is part of its campaign to sell teletext advertisements. It claims a daily audience of two million who watch an average of almost two hours a week, and says that 74 per cent of Oracle users report seeing teletext advertisements.

PRE-WAR TV – THE MARCONI CONTRIBUTION

Our article on pre-war television last month omitted to mention the Marconi Company's considerable contribution to the early development of television in the UK. By chance an interesting article on the subject appears in the September issue of the Marconi Broadcasting Division's publication *The Undistorted Truth.*

The Marconi Company set up a television research group in 1930, and in 1932 transmitted from Chelmsford on the 25m band a low-definition (50 lines, 12·5 frames/sec) head-and-shoulders picture which was received in Australia. More significantly the company had by 1932 produced a v.h.f. transmitter operating at 44·7MHz and capable of being modulated at 250kHz for TV use. The joint Marconi-EMI Television Company that developed the 405-line system was formed in March 1934.

ANGLIA CONSUMER WALLCHART

The second issue of the Anglia Consumer Wallchart, featuring many new items, is now available free of charge from Anglia Consumer, Burdett Road, Wisbech, Cambs PE13 2PS (telephone 0945 63281). Amongst the new items are a new range of teletext i.c.s, an extended range of audio i.c.s, and a competitively priced universal tripler.

TV CHIPS

Developments in i.c.s for TV and related uses continue apace. Mullard have developed a new videotext chip, type SAA5350, for level three text systems (broadcast teletext is level one). Level three text offers DRCS (dynamically redefinable character sets), i.e. the incoming signals contain data to programme the decoder's character generator, enabling foreign alphabets and improved graphics to be displayed (each character cell is based on a 12 × 10 dot matrix). The SAA5350 is known as a EUROM and offers many additional features including an 80 characters per row option in colour, multi-page memory, broadcast standard sync, serial and parallel attribute storage and cursor and smooth scroll.

The new Siemens TDA6000 chip for use in the i.f. section of a TV set has been developed for "hi-fi quality vision and sound". It uses frequency-phase-locked loop synchronous demodulation to ensure that no matter how complex the signal a weighted intercarrier signal-to-noise ratio of 50dB is achieved – even with superimposed text there's no crackle from the speaker. The performance specification includes 1° differential phase and one per cent differential gain (typical values for a tuning range of 1MHz and 150 per cent a.m.).

Mitsubishi have introduced a combined i.f./colour decoder i.c., type M51307SP, for use in NTSC receivers. This is claimed to be a world first and is intended primarily to enable more compact 14 and 15in. sets to be produced. Mitsubishi Electric plan to produce 200,000 of these 52-pin i.c.s a month. European i.c. manufacturers are known to be working on similar chips for PAL signals – Mullard's i.c. will be the TDA4501.

Philips have described a frame store, charge-coupled device i.c. for adding memory capability to TV sets. The chip is referred to as an MPIP (multiple picture in picture) i.c. and would enable the viewer to see nine channels at a time on the screen, view one "main" channel while monitoring three others in a strip at the side, or monitor just one extra channel in a small box at the corner.

THORN-EMI's NEW RESEARCH DIRECTOR

Dr. K.W. Gray, B.Sc., Ph.D. has been appointed Director of Research for Thorn-EMI plc, responsible for the Central Research Laboratories at Hayes, Middlesex and for advising the company generally on research and technology. Kenneth Gray was previously Deputy Director of the Royal Signals and Radar Establishment, Malvern, the largest electronics technology research laboratory in Europe. The development of stereo recording techniques and electronic, high-definition television broadcasting in the period from the late twenties to the mid-thirties have been amongst the many achievements of the Central Research Laboratories.

EEV's MASSIVE TV DISPLAY

EEV plan to enter a field at present dominated by the Japanese – large TV displays for use at race-tracks, sports stadia, etc. The company has spent £1m on developing a 27 × 20ft prototype screen that weighs twenty tons, claiming that the resolution is twice as good as competitive displays whilst the device consumes only a quarter of the power. The screen, called Starvision, uses some 10,000 miniature c.r.t.s assembled in groups of eight per glass module. This is a highly specialised field – only some thirty large, outdoor TV displays are in use worldwide, mainly in the USA – but EEV hope to achieve sales of about three a year.

DIY TELECINE

The Tele-Cine Converter, which costs only around £50, has been introduced by Markplan Ltd. (Old Colony House, South King Street, Manchester M2 6DQ, telephone 061-832 2765) to enable the images on slides and 8 or 16mm cine films to be transferred to videotape. It uses precision optics to transfer the film projector's output to a high-contrast rear projection screen from which the video camera records. The camera's controls can be used to compensate for faded film images and a bonus is easy editing and the possibility of adding zoom and soft-focus effects.

FIRST WIDEBAND CATV SERVICE STARTS

Thorn-EMI's subsidiary Swindon Cable has started the first wideband cable TV service in the UK, offering 13 channels initially (the network has 32-channel capacity). The 13 channels consist of BBC-1 and -2, Channel 4, three ITV channels, the Premier feature film channel, Music Box, Screen Sport, Children's Channel, a local Swindon programme, local teletext and a stereo radio channel. The service will eventually be available to 53,000 households, the cost of cabling being between £14m and £18m: 5,000 households will be able to receive the service by the end of the year. The basic charge to viewers is £8 per month, plus £7 extra for Premier (which is not available separately). Nearly a third of those initially contacted have agreed to take the service.

TRAINING TAPES

Flintdown Ltd. (Montauban Chambers, 339 Clifton Drive South, Lytham-St. Annes FY8 1LP, telephone 0253 725

499) have produced three videotape programmes on the theory and practice of colour TV. Part 1 deals with the colour signal itself, with a detailed account of NTSC and PAL encoding; Part 2 covers PAL decoding, with practical demonstrations of decoder fault conditions; Part 3 covers receiver installation and setting up. The cassettes are available in all formats. An additional audio-visual tape/slide programme covers soldering techniques.

CCTV CAMERA CONTROL SYSTEM

Pelco Coaxitron, a low-cost, computerised system for the remote control of up to sixteen CCTV cameras, has been introduced by Norbain Imaging Ltd. (Norbain House, Boulton Road, Reading, Berkshire RG2 0LT, telephone 0734 864 411). The control signals use the video coaxial line to avoid extra cabling: pan and tilt, auto-scan, variable-speed zoom, focus/iris/auto-iris setting, on/off switching, wash wipe and infra-red illumination can all be controlled. The system is a preprogrammed, non-addressable one using an intermediate video switcher to address the cameras.

NEW TVs

The new Salora DigiComputer range incorporates a microcomputer to provide an "automatic equalising system". This enables the user to preset the colour, contrast, brightness and sound levels separately on each of 27 channels to cater for different input sources. The basic J chassis is used, featuring the Ipsalo-2 circuit (see *Television*, September 1984). Other features include parallel sound and a tuning system that covers 100 channels with 27 storage positions. A full range of optional extras is available.

The recently introduced Ingersoll Model XK510 is a combined 4½in. monochrome receiver, m.w. and f.m. radio receiver and a digital alarm clock with twelve-hour red LED display. The suggested price is around £130.

The 1120 9in. colour portable is the first set from Philips to be fitted with the new flat, square type tube. Its suggested price of £260 may seem on the high side but the set's features include mains/battery operation, 60 channel presets with direct access via a keypad beneath the screen, and a comprehensive set of sockets to enable the set to be used as a domestic or professional monitor.

BACK INJURY

The problem of back injury due to lifting TV sets has come up again with the case of Colin Flowerday who is claiming damages against Visionhire – regular readers will recall Harry Todd's case against Radio Rentals. Colin Flowerday says the injury occurred whilst carrying a Philips 520 series G8 set which he estimates weighed some 60lbs. He is now a permanent invalid.

VCR LOCKS

Mention of VCR locks was made in this column last month, in particular the lock fitted to the new Grundig Model VS200. We have been asked by Robert E. Barwick, a freelance electronics engineer from Stockport, to mention that he filed a patent application covering VCR locking techniques on November 4th, 1984. Bob Barwick's Roblock system provides selective VCR disablement so that the machine will still make timed recordings. He is of the opinion that Grundig's lock infringes his patent and is in dispute with Grundig over the matter.

30V Battery Eliminator

Peter H. Dolman, T.Eng.

The 15V battery eliminator circuit featured in the letters page recently (August) prompts me to report on a similar project, this time a 30V battery eliminator for use with the well-known Rank u.h.f. signal strength meter (Mastercare have been selling these off cheaply). The latest version of this instrument uses two batteries, a 9V PP7 for the receiver circuitry and a 30V B123 to supply the varicap tuning voltage.

The B123 is expensive and difficult to obtain. To overcome the problem the circuit shown in Fig. 1 was devised. It enables the 30V supply required to be obtained from the PP7 and uses readily available components. The circuit consists of an oscillator and rectifier, the oscillator being built around the line oscillator coil used in the Z504 timebase panel (Rank A823A chassis). The circuit can be built on a small piece of Veroboard – use 0·5W hystab resistors.

Output is 30-36·5V for 9V supply variations between 5·5-9V. Operation is maintained with a supply exceeding 9V, which is desirable as new batteries can deliver potentials somewhat above the rated value. The ripple is less than 20mV. Circuit operation is dependable over a wide temperature range: it's tolerant of inadvertent reversal of the 9V supply polarity and shorting of the 30V output.

A 27V zener diode should be added across the tuning potentiometer in the signal strength meter to ensure that the channel tuning range remains 21-68 regardless of battery ageing effects down to 5·5V. Even below this the meter is usable, the most noticeable effect being loss of sensitivity – this falls off fairly rapidly below 7V (the manufacturers recommend that the battery should be replaced when its on-load voltage falls below 7·5V).

Adjust the coil for maximum output, on load, measured at the cathode of the BY206 rectifier diode. The tuning is extremely flat – correct adjustment corresponds to a collector waveform period of around 40μsec.

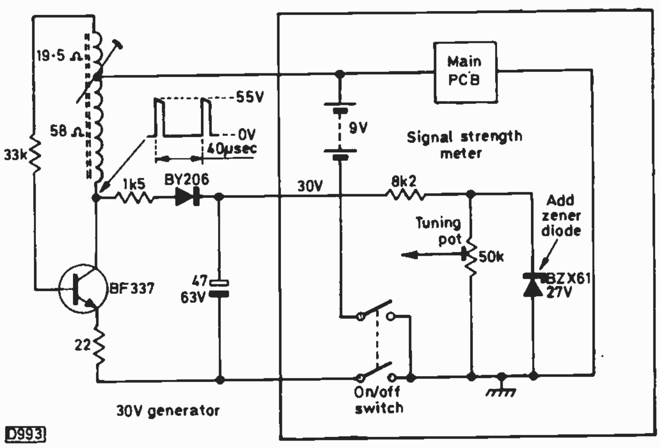


Fig. 1: Oscillator circuit used to obtain a 30V tuning voltage supply from a 9V battery.

All About Lenses

Vivian Capel

Increasing use is being made of video cameras in conjunction with VCRs, in particular with portable machines. The electronic aspects have been touched upon in other articles, but what about the big chunk of expensive looking optics that sits at the front of the thing? Photographic enthusiasts will have few difficulties in mastering its use since they'll be familiar with all features except for the zoom facility. Those whose experience is limited to the simpler types of film camera may find the lens and its various adjustments rather more daunting – in fact many good shots can be lost while the operator is fiddling with the various controls, trying to get everything right. The ability to make quick adjustments to capture fleeting shots comes with experience in handling a camera, but an understanding of the lens – what it does, how it works and its limitations – goes a long way towards obtaining successful results. We'll start off with some basic optics.

Refraction

Contrary to popular belief, the speed of light is not constant. It slows down when it passes through a dense, transparent material such as glass. If the light falls on to the glass surface perpendicularly there's no observable effect: if it strikes at an angle however the ray is bent. When the ray leaves the glass on the other side it's again bent, assuming that the path of the light is not at right angles to the glass surface. A perpendicular path is known in optics as the normal. The bending effect is termed refraction and the amount of bending a given material causes is termed its refractive index. The latter is the ratio of the velocity of light in the material to that of light in a vacuum. A vacuum thus has a refractive index of 1. Air at sea level has an index figure of approximately 1·0003, but the difference between this and a vacuum is so small that it's usually taken to be 1. The figure for water is about 1·33, and for glass 1·5. Glass varies according to its composition however: flint glass has a high refractive index while the figure for crown glass, which is made without metallic additives, is lower. As we shall see, this can be very useful.

The angle at which a light ray strikes a glass surface relative to the normal is termed the angle of incidence (see Fig. 1), while the angle from the normal of the refracted ray within the glass is its angle of refraction. The one depends on the other: if the angle of incidence changes, so does the angle of refraction (to be more technical, the sine of the angle of refraction is equal to the sine of the angle of incidence divided by the material's refractive index).

Convex Lens

It follows from this that if a bunch of parallel light rays is directed on to a curved glass surface the angle through which each ray is bent will differ – because the curvature encountered by each ray differs. If the surface is convex, there will be a point at which the rays converge after emerging from the other side of the glass. A glass plate with one convex side thus acts to concentrate or focus the light passing through it at some point on the far side. It forms a simple lens. If the second side is also convex (see Fig. 2) the rays will again be bent, bringing the focal point closer to the lens. It's the convention with such a lens to regard the right-hand curve (on the left) as positive and the left-hand curve (on the right) as negative. Despite this they bend the rays in the same direction – because at the first intersection the rays pass from a low-density medium (air) to a high-density one (glass) while at the second intersection the passage is from high to low density.

Lens Power

The total curvature of the lens is obtained by subtracting the reciprocal of the radius of one curve from that of the other: when this is multiplied by the difference between the refractive indexes of the materials (glass and air) we get the power of the lens. The unit of power is the dioptre. Power is also equal to the reciprocal of the focal length in metres. Thus a lens with a focal length of 1 metre has a power of 1 dioptre.

Concave Lens

A lens may have one or both surfaces concave instead of convex. These will diverge the beams instead of converging them (see Fig. 3). With such a lens the beams are considered to come from an imaginary focal point at the front of the lens, the distance between this point and the lens being taken as its focal length. Such a lens is said to be negative while a convex lens which converges the light rays is termed positive.

Chromatic Aberration

The angle of refraction is determined by the wavelength of the light as well as its angle of incidence and the refractive index of the glass: short wavelengths (blues) are refracted at slightly different angles to the longer ones (reds). As a result, the image produced by a simple lens has coloured outlines, red on one side and blue on the other. This is called chromatic aberration.

The colour separation produced by a positive (convex) lens can be corrected to some extent by following it with a negative (concave) one. As both lenses have the opposite effect, the positive one must be the stronger to achieve a convergent effect from the combination. By making the convex lens of crown glass (low refractive index) and the concave lens of flint glass (high refractive index) almost complete cancellation of colour fringing is achieved. Two such lenses cemented together to form a single unit are called achromatic, literally "colourless". This doesn't mean that the lens won't transmit a coloured image of course: it means that the lens doesn't split white light up into the colour primaries.

Focus

In considering the focal point we referred to a bunch of parallel light rays. Only rays that come from very distant objects can be considered to be almost parallel however.

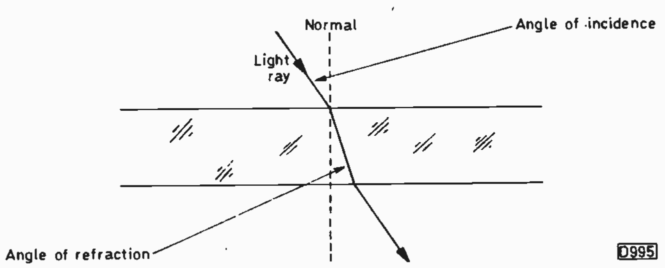
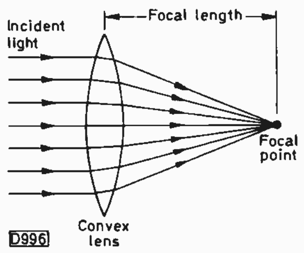


Fig. 1: When a ray of light strikes a dense medium such as glass it's refracted. The angle of refraction away from the normal is dependent on the angle of incidence.



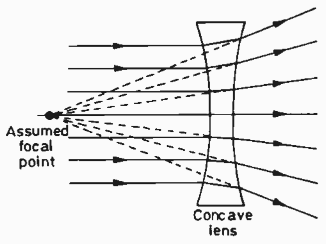


Fig. 2 (left): When parallel rays encounter a convex glass surface they are bent inwards. The angle of refraction is greater for the outside rays than for the inner ones because the angle of incidence is greater, due to the surface curvature. Thus all the rays converge at a certain point (the focal point).
Fig. 3 (right): With a concave lens the rays are refracted outwards and appear to come from a single point.

All other rays are divergent: the closer you are to their point of origin, the more divergent they are. With a lens consisting of several elements, the light source may be a few feet from the first (called the objective) lens element, but the source for succeeding elements is much closer – the lens immediately in front. The focused image produced by a lens appears at a distance from it that depends on the lens's focal length and the distance between the lens and the light source. The actual relationship is based on the reciprocal of each dimension: the reciprocal of the distance of the focused image from the lens is equal to the sum of the reciprocals of the focal length of the lens and the distance of the object in front of it.

Thus in theory a lens or lens system can produce a truly focused image only when the object is at a certain distance in front of the lens. In practice however anything from a few feet to infinity is in reasonable focus, because the geometry of divergent rays is such that their deviation from the parallel state at such distances is negligible. For nearby objects the deviation is much greater of course. Many simple lenses are of the fixed focus variety: they save the fuss of focusing each shot but cannot be used for close work unless an extra lens is added. Variable focus lenses have a movable element that changes the focal length of the whole system, permitting close-quarter focusing. Moving objects that are close must stay at the same distance however otherwise they'll go out of focus, since focusing is critical with close objects.

Macro Facility

With some lenses it's possible to extend the distance between the optical system and the rest of the camera by means of either an add-on tube or a built-in spacing arrangement. This is called a macro facility and allows very close focusing – to within millimetres from the lens. Stamps, photographs and other small, flat objects can thus be brought into focus. At such very close distances the lens itself may obstruct the light, making it necessary to use back lighting or some other special means of illumination. An add-on lens can be used to achieve closer than normal focusing with a camera that doesn't have a macro facility – alternatively if the camera has a detachable C-mount lens this can be unscrewed a few turns – be careful not to unscrew it too far.

Depth of Field

Depth of field is the axial distance over which objects remain in focus and is a particularly important factor. With a shallow field, objects remain in focus within confined limits only, being defocused before and beyond these limits. A deep field has much wider limits.

Now depth of field is inversely proportional to the square of the magnification. As a camera lens reduces the size of the focused image, it follows that its depth of field is directly proportional to the square of this reduction in size. So the smaller the image, the deeper the field. Hence a video camera with a $\frac{2}{3}$in. pickup tube has a deeper field of focus than a 35mm film camera in the same conditions, though not as deep as an 8mm cine camera's field.

Another consequence of this is that because a high-magnification (telephoto) lens has a low reduction factor its field of focus is shallow. As it's proportional to the square of the magnification, the field depth reduction with a ×8 zoom will be 64 times from wide angle to telephoto. Careful focusing is thus required with telephoto settings. An out-of-focus background for special effects is sometimes obtained by using a telephoto lens focused on a close-up foreground. Field depth is further restricted by using a large aperture setting.

Another telephoto characteristic is foreshortening – the foreground is magnified less than the background. The result is that they appear to be closer together than normal while movement towards the camera seems to be slow. Wide-angle lenses have the opposite effect: the backgrounds appear to be more distant and smaller, with the speed of moving objects that approach the camera appearing to be faster.

Blooming

Individual lens elements are commonly given a coating, or "bloom", of magnesium fluoride which is deposited in a vacuum chamber. A more accurate and expensive method is electron beam coating (EBC) – a layer is built up to the required amount by successive microcoatings. Why is this necessary?

When light strikes a polished glass surface some of it is reflected, at angles governed by the angles of incidence. With a multi-element lens system internal reflections can cause loss of light transmission in addition to producing ghosts or multiple images and all sorts of undesirable effects. Blooming is done to prevent such reflections. The thickness and nature of the coating has to be carefully chosen and its application rigidly controlled.

Aperture

Even with a video camera that incorporates automatic sensitivity control circuitry it's necessary to be able to regulate the amount of light that passes through the lens. Without this either the tube would be overloaded in bright sunlight, causing flattened highlights, or dim, noisy pic-

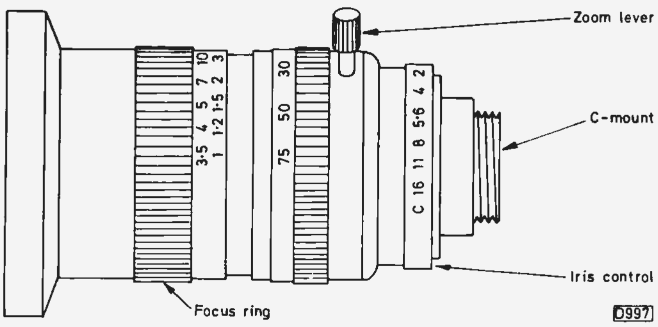


Fig. 4: A typical detachable zoom lens. The first control from the end is the focus ring, which is calibrated in feet and metres. More adjustment is needed at the near end of the scale than the distant one, as the wider spacing of the calibration shows. Next is the zoom control, which is sometimes calibrated with focal length. Finally there's the iris control, which is marked with the f numbers. The C position denotes closed, i.e. no light enters.

tures would be obtained at low light levels – possibly both conditions might be experienced. For this reason most lens systems incorporate an iris consisting of several leaves of matt black metal arranged so that the central aperture between them can be enlarged or reduced. Others with automatic aperture control by means of an electronic eye usually employ a single leaf in which there's a widening channel to admit an increasing amount of light as the leaf is advanced.

Specific aperture openings have values which are specified by f number. These are based on the ratio of focal length to aperture diameter and determine the amount of light admitted. There are click stops on some lenses with manually controlled apertures, though the iris is continuously variable. Stop numbers are f1·4, f2, f2·8, f4, f5·6, f8, f11, f16 and f22. The lower the number the larger the aperture: each stop up reduces the amount of light by half. The largest aperture for a particular lens may not correspond with a standard f number, while the cost of a lens rises dramatically with small increases in maximum aperture. Large apertures are useful for film but are not necessary for video cameras using modern, high-sensitivity pickup tubes.

Zoom Lenses

Amateur photographers will be familiar with most of what's been said so far. There's one feature of the video camera lens that will probably be new – except perhaps to cine enthusiasts. This is the zoom feature (see Fig. 4). By means of this the view can be changed from a wide-angle, distant scene to a narrow-angle, close-up one without moving the camera. This is done without materially affecting either the focus or the amount of light passing through the lens, and is accomplished by a complex arrangement of lens elements. A dozen or more individual optical units assembled in groups are required, relative movement between the groups producing the zoom effect.

Focus is not always maintained over the whole range with the cheaper zoom lenses, so there may be loss of definition at one or both extremes. Lenses for home video use are generally not made to the same standard as photographic ones: since VCR definition limitations tend to mask lens defects, a better and much more expensive lens will give no observable improvement. Another factor is that the aperture is not, as it should ideally be, kept constant over the whole zoom range. This is known as ramping and is more prevalent over large zoom ranges. A video camera's automatic sensitivity control circuits compensate for minor changes, so this is less of a problem than with film.

The focal length of the lens is changed when the zoom control is operated. Zoom lenses are usually rated by their focal length, a typical example being 12·5-75mm. The lower figure is the wide-angle setting and the larger the telephoto one. Notice that in this example the ratio is 6:1 – the zoom is said to have this range. The largest range for amateur lenses is around 10:1. For lower price cameras the range may be as low as 2:1. This will still give useful results however. Excessive use of zoom is irritating and is usually due to inexperience. The full zoom range is rarely required.

The principal advantage of a zoom lens is that framing of the picture can be achieved without having to get closer to or farther away from the subject. Remember the points made earlier about foreshortening: if good perspective and separation of the foreground and background are desired, it's often better to use a medium- to wide-angle setting and get closer to the subject physically. Another factor to bear in mind is that with high magnification settings the slightest movement produces an unsteady picture. Always use a tripod for these. Unsteadiness has much less effect with wide-angle settings.

Two viewing angle figures are often quoted for each zoom limit, one horizontal and the other vertical – because the picture is wider than it is high. Typical horizontal angles are 38° at 12·5mm, 27° at 25mm, 7° at 75mm, 5° at 11mm and 4·5° at 110mm – these vary between models.

A motorised zoom gives a smooth zoom in or out and can be stopped at any point. Many enthusiasts prefer manual operation however, as the zoom can be slowed towards the end, giving a more pleasing effect than the abrupt stop of a motor. In addition the speed can be varied to suit the subject, from a dramatic quick zoom in to a leisurely, almost imperceptible inching forward or backward. A two-speed motor zoom is an improvement but still lacks the flexibility of manual control.

How Lenses Come

Most CCTV cameras are sold without the lens. You buy the model you want then choose the lens, which is screwed in and can be changed over for another at any time. Because of the complications introduced by motor zooms, auto-irises and other such features, most home video cameras have integrated lenses that cannot be changed.

Used surveillance monochrome CCTV cameras can often be bought cheaply. This is a way of getting into home video shooting at minimum expense. Always ask to see the camera demonstrated via a video monitor, and watch out for vidicon tube burns. These show up as white patches that don't move as the camera is swung round.

Most video cameras are fitted with a ⅔in. pickup tube, though some have 1in. tubes. Lenses intended for 1in. tubes can be used with a ⅔in. tube camera, though the angle of view will be narrower than that quoted for the lens. The reverse, i.e. using a ⅔in. tube lens with a 1in. tube camera, cannot be done successfully.

Whatever the lens on your camera, it's worth experimenting with the various features. Try the effect of different settings, noting such characteristics as depth of focus, minimum distance focus and foreshortening. You'll then appreciate its limitations and strengths and will be able to use it to best effect when making serious recordings.

A Look at Monitors

Part 2

Eugene Trundle

Part 1 last month was mainly concerned with monitor requirements – resolution and other characteristics. This month we shall concentrate on displays, in particular with the various types of colour tubes used in monitors, and the input standards in use.

Monochrome Monitors

Monochrome monitors are used mainly as computer display devices. An increasing trend is to use a green-phosphor tube, the P31 type (medium short persistence) being the most common. Green is generally accepted as being the most restful colour to watch and corresponds to the greatest sensitivity of the human eye in terms of brightness and definition. If a long-persistence green phosphor (P39 type, decay about 50msec) is used, the interline flicker mentioned earlier is considerably reduced, though too long a persistence will leave noticeable comet tails when scrolling the display. Some monitors have green light filters over what's basically a black-and-white screen. This is cheap but inferior on the grounds that some of the phosphor light is wasted while the long persistence characteristic of some green phosphors is not present. Amber phosphors (type LA) are also appearing in the latest monochrome monitors. For black-and-white monitors in professional applications, particularly where they are used alongside colour monitors, it's important that the colour temperature of the light emitted is illuminant D – most domestic monochrome tubes give a very cold, bluish image.

In a conventional monochrome tube the electron beam diameter is typically 0·2–0·4mm at the point where it strikes the phosphor screen, and this is well suited to a 625/50 standard display. Indeed, too small a spot diameter will leave dark spaces between the scanning lines, which can be a definite disadvantage. The ideal scanning spot diameter is that which permits the lines of a correctly interlaced raster to just touch one another. For a 51cm (20in.) tube this is 0·5mm and for a 37cm (14in.) tube 0·3mm. An ordinary monochrome tube and video amplifier can cope with 80 character per line data (see later) without too much difficulty.

Conventional picture tubes suffer from various forms of scanning spot aberration, mainly as a result of the deflection mechanism. For very high resolution applications, high-grade tubes are available with special gun assemblies that have high-quality electron lenses providing a small spot size. Special scan yoke assemblies are also available to minimise deflection defocusing and astigmatism. Some quite inexpensive monitors (the Ferguson 12in. green screen Model MM02 for example) have dynamic focusing – a line-rate parabola is fed to the tube's focus electrode to compensate for the longer beam path at larger deflection angles.

Using the above techniques, allied sometimes to magnetic focusing with an axial coil carrying a preset and fed with a stabilised current, the resolution can if required be pushed well beyond 1,000 lines without too much difficulty.

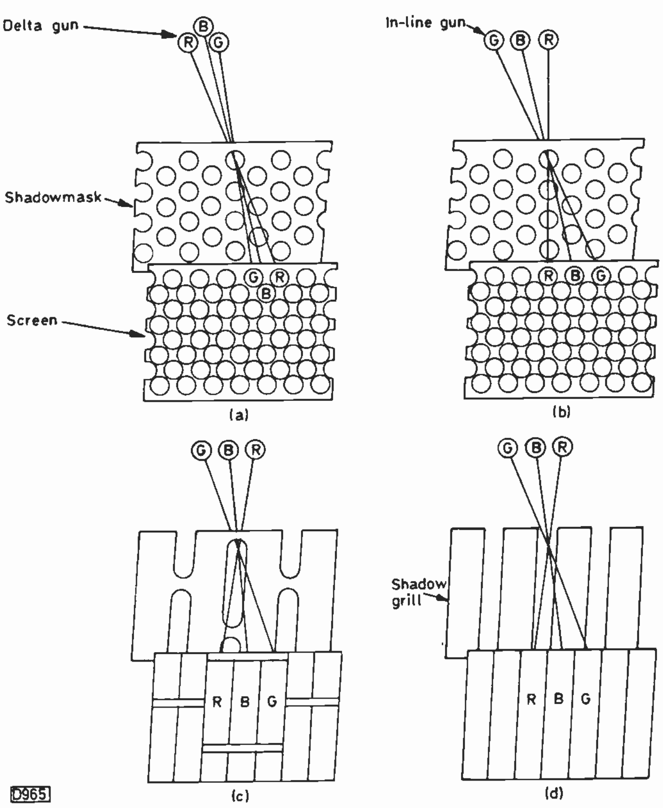


Fig. 7: The four alternative gun/mask/screen shadowmask tube configurations, (a) delta gun, (b) dots with in-line gun, (c) striped screen with slots and in-line gun, (d) Trinitron system.

Colour Monitors

Apart from the last sentence, the foregoing comments also apply to colour monitors. In this case however the crucial limiting factor for resolution with a shadowmask tube of whatever type is the dot structure on the screen. It's well known that the colour screen consists of a glass faceplate whose rear surface is coated with a matrix of phosphor dots or a series of vertical stripes (the principle remains the same, but to simplify the description we'll stick to dots for the moment). The dots are arranged in groups of three (triads) and plainly no pixel can be smaller than one triad. So the dot spacing determines the tube's resolution capability – dot spacing is the distance between the centres of each triad group and corresponds to the holes in the shadowmask (whether they're circular, rectangular or, as in the Trinitron tube, continuous slots). The triad groups can be arranged in four ways, as shown in Fig. 7. The delta-gun arrangement – Fig. 7 (a) – is still very much alive in the world of monitors, being used for very high-quality, high-definition picture monitors where the ultimate in performance is required: a broadcast grade 1 monitor may be regarded as virtually a measuring instrument. Versions of delta-gun tubes are available with four times as many dots as conventional colour tubes. A 51cm tube of this type (0·31mm dot spacing) can resolve 770 TV lines on a total of 1·32 million triads – four million individual dots!

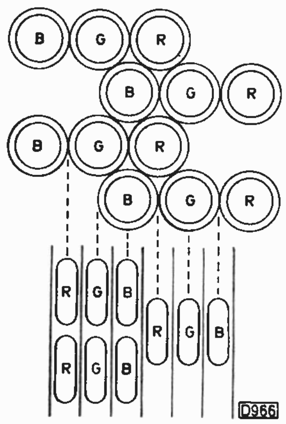
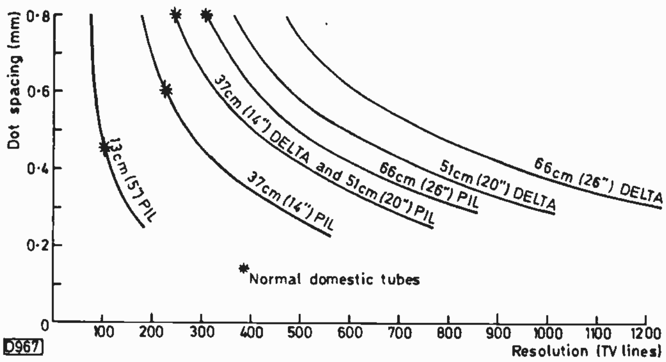


Fig. 8 (left): To achieve the same order of resolution, a striped screen tube needs a finer "triad" structure than a delta-format tube.

Fig. 9 (below): Resolution capabilities of various types and sizes of colour tubes. A pixel width of two triads is assumed for reliability and readability. In practice display lines can, with difficulty, be discerned down to one triad per pixel.



The in-line dot system – Fig. 7 (b) – combines the advantages of the in-line gun approach (no dynamic convergence adjustments) with the high resolution capabilities of the delta-gun tube and is a good compromise for high-quality monitors. Its resolution performance falls between those of the delta and slot systems. The latter, Fig. 7(c), is the standard arrangement used in current consumer TV tubes.

Slot tubes are in fact the most common types found in monitors and share with the Trinitron type – Fig. 7 (d) – the advantage over delta-gun tubes of higher brightness for a given beam current. This stems from the greater "transparency" of the shadowmask (an improvement of around 20 per cent). The reason for the poorer horizontal resolution capabilities of slot-mask, in-line gun tubes (compared to delta- and in-line dot types with a comparable phosphor pitch) is shown in Fig. 8. From this it can be appreciated that for the same subjective fineness in the picture structure the width of each phosphor stripe must be about half the diameter of the individual phosphor dots in the delta format. This however is traded off against vertical resolution, which in the slot tube is not limited by the dot structure – the horizontal tie bars between triads are negligibly thin (30–100 microns, i.e. 0·03–0·1mm) compared with the scanning lines themselves. So the vertical pixel count depends on beam diameter and scanning line structure. This is also the case with the Trinitron of course.

Dot Pitch

For consumer tubes the standard stripe pitch is 0·6mm for small screens, i.e. 37cm (14in.), and 0·8mm for 51, 56 and 66cm (20, 22 and 26in.) screens. Thus a 37cm tube will have almost 1,500 vertical phosphor stripes across its display width of about 281mm, giving 500 as a theoretical maximum number of pixels per scanning line. A 26in. 20AX or 30AX tube has 650 triads per 444mm display width and a 20in. (404mm display width) tube some 505. Taking this last figure and harking back to our previous calculations on line structure and pixels, with 430 lines as a practical vertical definition figure and 570 or so dots along each line, the broadcast analogue picture has some 430 × 570 = 245,000 pixels. No problem with resolving the scanning lines themselves but the stripe pitch, with its 500 triads across, will considerably reduce the total available pixel count – in fact to below 150,000 because to avoid what might be called a "horizontal Kell" one broadcast pixel ideally needs to cover the width of two phosphor triads. That's why you won't see the 5.25MHz test card gratings on an ordinary colour TV screen – and in many cases miss the 4·5MHz ones too, even with no luminance notch filter in operation.

The worst performers in this respect are the very small 13 and 15cm (5 and 6in.) colour tubes used in mini-portable colour sets. With these the dot pitch is not reduced in proportion to screen area – in fact they have a screen matrix comparable with those of their bigger brothers. These tubes can resolve only 100–200 lines per picture width, though higher resolution types are available for use in mini-monitors, VTR editing consoles and as viewfinders in colour TV cameras.

To increase the display's information density a finer dot pitch is required. Slot-mask tubes are available with an 0·43mm pitch, giving about 860 dots per line in the 51cm size and 650 dots per line in the 37cm size; and with an 0·31mm pitch, which gives almost 900 dots per line in the 37cm size. These are known as medium- and high-resolution types respectively. To indicate the relative costs of these tube types, the current Microvitec price list quotes £199, £299 and £440 respectively for 37cm monitors in standard-, medium- and high-resolution grades. The differences are very largely accounted for by the tube prices alone. Fig. 9 indicates the resolution capabilities of some

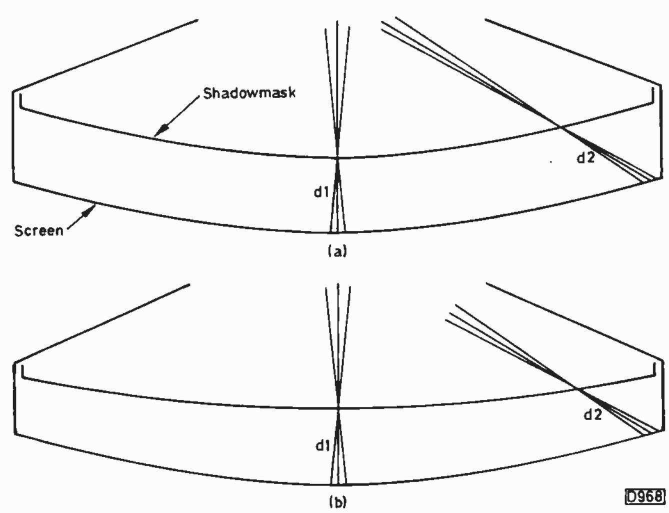
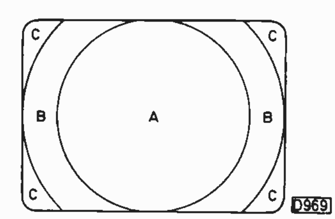


Fig. 10: (a) Constant mask/screen spacing used with earlier delta-gun tubes. Distance d2 is greater than d1, and the phosphor dots are more widely spaced at the extremes of the display. (b) When the mask and screen have different radii distances d1 and d2 remain the same and the dot pitch is uniform over the entire screen area.

Fig. 11: Convergence error zones.



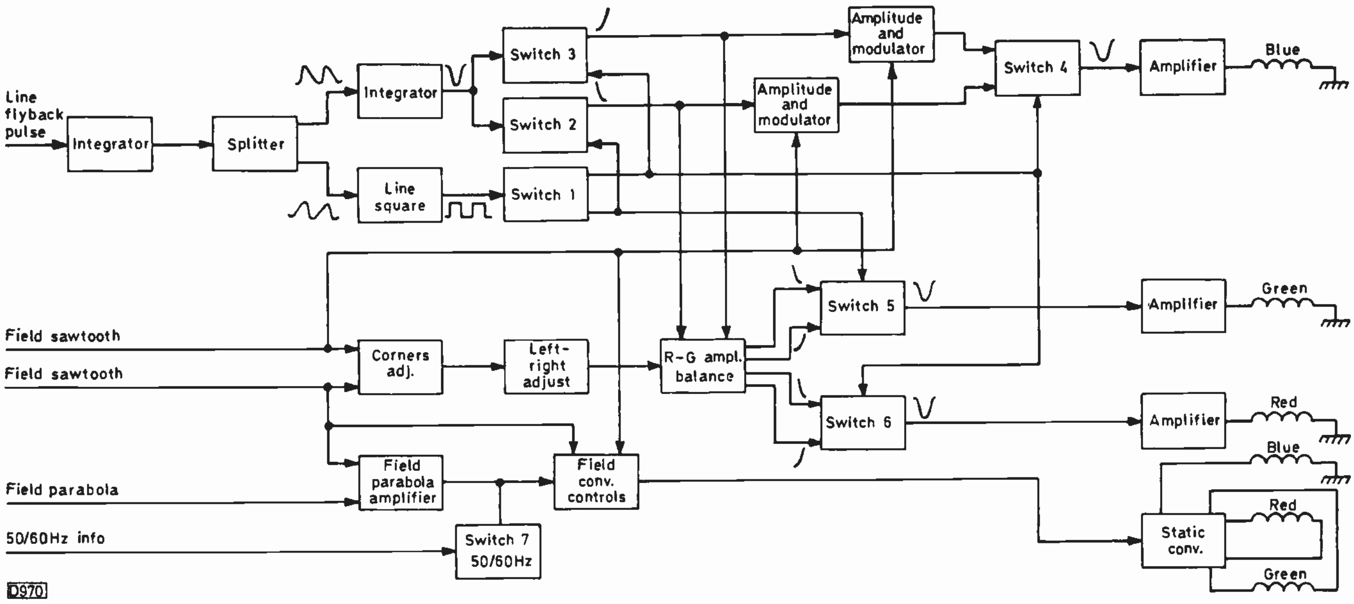


Fig. 12: Block diagram of the precision convergence system used by Barco with high-resolution delta-type tubes.

typical tubes in terms of lines per picture width. It's interesting to relate this to Fig. 4.

Pitch Grading

In earlier delta-gun tubes the spacing between the shadowmask and the phosphor layer was constant – see Fig. 10 (a) – which meant that the dot spacing was wider towards the edges and corners of the screen. It's easy to see why. The three beams cross over at the mask aperture and then diverge on to their own phosphor dots. At large deflection angles the divergent paths (mask to phosphor) are longer, so the three beams spread farther before striking the screen: hence the need for progressively larger triads towards the extremes of the display. The situation is a little more complex in practice due to the mechanics of the deflection process and the need to provide a larger guard band (for beam landing tolerance, i.e. purity) at the edges of the display. The latter requirement is achieved by making the mask holes 5–10 per cent smaller in these areas. This grading technique marginally reduces both the brightness and resolution at the extremes of the picture.

Most in-line gun tubes have mask and screen radii that result in a constant path length for the diverging beams as shown in Fig. 10 (b). This avoids the need for pitch grading, though I'm told that the new FS (flat, square) tubes have some grading.

Beam Diameter

In an ordinary colour tube the beam diameter is about 0·45mm at its focal point, and in conjunction with an 0·6 or 0·8mm stripe spacing this is adequate. Beam diameter (or scanning spot size) depends on several factors, the main one being beam current. To maintain a small spot size, a monitor's beam current limiter circuit comes into operation at a lower level (450–600μA total for the three beams, depending on screen size) than in a conventional TV set in order to prevent defocusing. For medium- and particularly high-resolution tubes an additional design feature is a special gun incorporating a high-performance electron-optic lens to ensure a very finely focused scanning spot. The scanning yoke requirements are also more stringent with these tubes, not only with regard to deflection defocusing and astigmatism but also in terms of convergence performance.

Convergence

There's little point in improving one aspect of a system without upgrading the rest of the links in the chain to match. If the capabilities of a high-grade tube's fine dot structure are to be exploited fully the convergence performance must also reach a high standard, ideally converging to within half a pixel over the entire screen area. This goal in unapproachable with current tube technology! The best high-definition, in-line gun tubes can achieve maximum error figures of 0·3, 0·8 and 1mm in zones A, B and C shown in Fig. 11. This compares with about 0·4, 1·2 and 2·2mm respectively with a production domestic tube. Top-flight delta-gun tubes manage, in conjunction with fairly complex dynamic convergence circuits and controls, to contain the errors within 0·3, 0·5 and 0·7mm for a 51cm screen and 0·3, 0·4 and 0·6mm for a 37cm screen. Corner convergence is far less critical for picture reproduction than for data displays, where small characters and fine detail can reach right to the screen edges.

A block diagram of the convergence system used in the Barco delta-gun monitor is shown in Fig. 12. A line flyback pulse enters at the upper left in the diagram and is first integrated to produce a sawtooth, then polarity split to provide complementary sawtooth waveforms. The negative sawtooth is further integrated to form a parabola. The positive sawtooth goes to a threshold switch whose output is a squarewave – high for the first half of the line scan, low for the second half. Complementary squarewaves go to switches 2 and 3 whose outputs consist of the first and second halves of the parabola respectively. Each half is separately controlled in amplitude and, for corner convergence purposes, is modulated by an adjustable field-rate sawtooth before recombination at switch 4 and application to the output amplifier and blue horizontal dynamic convergence coil.

The red-green line dynamic convergence system uses the same half parabolas from switches 2 and 3: each is processed in a voltage-controlled attenuator i.c. which has two outputs and two control lines. For each chip, one control line sets the amplitude of both outputs while the

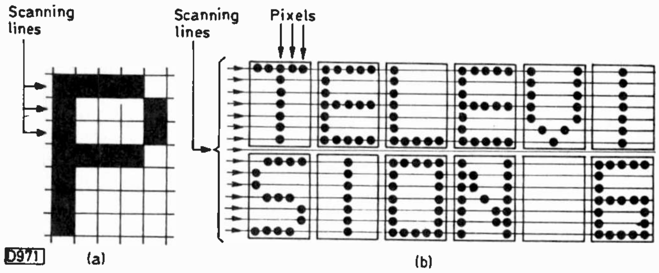


Fig. 13: (a) 7 × 5 dot matrix used for data displays. (b) Dots, cells and their relationship to the TV raster.

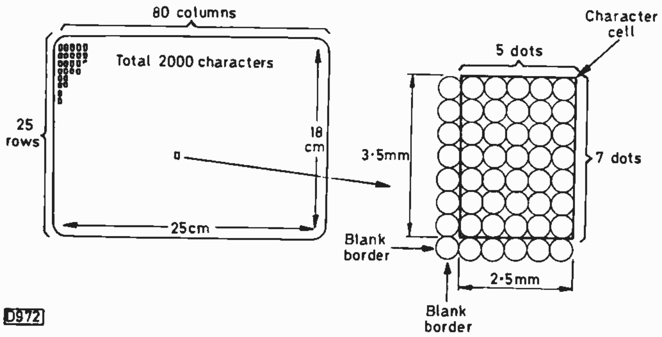


Fig. 14: Character structure for an 80-column display, related to a 37cm screen. Beam diameter is of the order of 0·45mm.

other determines the ratio between them. The two half parabolas are combined in switches 5 and 6 for application to the red and green output stages and convergence coils.

Field dynamic convergence is conventional so far as compass points N, S, E and W are concerned: a transistor switch 7 equalises the operation for 50/60Hz scan rates.

Corner convergence adjustments are based on the action of a pair of diode clamps, across each of which appears only one half of the vertical sawtooth waveform: thus one bank of controls operates on only the upper half of the display while a second bank operates on the lower half. The carefully shaped half sawtooth waveforms pass into the previously mentioned electronic attenuator chips as control voltages.

In all there are 22 dynamic convergence controls, ten of which are concerned with corner convergence. Three additional controls are provided for static convergence. Nine i.c.s and thirteen transistors are used in the circuit.

Colour Phosphors

A monitor will normally have phosphor emission colours that match the transmission parameters. These colours are much more relevant to analogue picture monitors of course than to those intended for data display. The normal standards are specified by the EBU and are known as the EBU chromaticity co-ordinates. For data monitors different co-ordinates can be used, especially where longer phosphor decay times are required to suppress interline flicker in high-definition displays.

We touched on phosphor persistence when discussing monochrome tubes. Standard persistence as used in ordinary colour tubes is JEDEC classification P22. The red decay is about lmsec, green 150μsec and blue 100μsec, in each case to ten per cent of initial brightness. Colour tubes for data display are available with longer persistence of up to 150msec – except for the blue phosphor, where no material has yet been found that combines the correct primary colour with a long decay time. Hence the "long-persistence, short-blue" type tube whose characteristic is better flicker performance combined with a tendency to show a yellow comet tail effect on scrolling characters. Long persistence phosphors have a lower lumen efficiency than medium and short types, giving about 50 per cent less light output for the equivalent beam energy.

Computer Displays

In a 625/50 standard TV display the basic pixel count is approximately 575 × 575 × (4/3) = 440,000: provided the video amplifier and display tube are up to it, more pixels can be introduced by increasing the dot count per scanning line. For the purpose of displaying characters and graphics, the raster is divided into rows and characters, the information density possible depending on the number of these. Starting with the simplest displays, i.e. standard teletext, Prestel and low-price computers, the screen area is divided into 23 rows of information with each row containing a maximum of forty characters. So the information density is 920 characters. Each character can be regarded as a cell which consists of a matrix of dots: these dots are the basic TV pixels. There are various cell arrangements, 7 × 10, 7 × 9 and particularly 5 × 7 being common. The letter P in a 5 × 7 dot matrix is shown in Fig. 13 (a), and the arrangement of the character cells across the screen in Fig. 13 (b). To separate adjacent characters and rows, a single line of blank dots is inserted beside and below each character cell. Thus each complete 5 × 7 cell is in fact 6 × 8 pixels.

We've already seen that each pixel-dot needs to cover two phosphor triads to ensure adequate resolution and visibility. 40-column text is easily reproduced by standard-resolution tubes, as witnessed by the excellent teletext displays on domestic TV sets. The next step is 80-column text, e.g. mode 0 with the BBC microcomputer. Here we have 25 rows, giving a total data density of 2,000 characters. In this mode each 5 ×, 7 matrix cell is about 2·5mm wide and 3·5mm high on a 37cm screen (see Fig. 14), so a high-resolution tube with 720 or 800 dot capability across its screen width is required. A standard-resolution tube will display 80-column text, but it's tiring to decipher and not suited to long-term viewing.

Computers used for fine graphics in CAD, imaging, mapping and simulation can generate 132-column graphics (even more for special purposes like digital high-resolution TV) so a very high-resolution tube is required, preferably larger than 51cm if this sort of data density is to be discerned and appreciated!

Character-generator Outputs

Whether the data source is off-air, off-line, a microcomputer or a full-blown computer, the data displayed is generated inside a character generator chip. The video signals from this consist of square pulses that are precisely timed with respect to the line and field scanning rates. Plainly, the higher the column count the narrower the pulses. In the case of a colour display they are separately generated for R, G and B, and will usually be at TTL level, i.e. 5V on, 0V off. Simple on/off signals used to control each tube gun can give the three primary colours plus, in combination, their complementaries and white, i.e. a total of eight distinctive colours – white, yellow, cyan, green, magenta, red, blue and black, corresponding to the standard colour bars.

Most ordinary home computers costing £100–£200

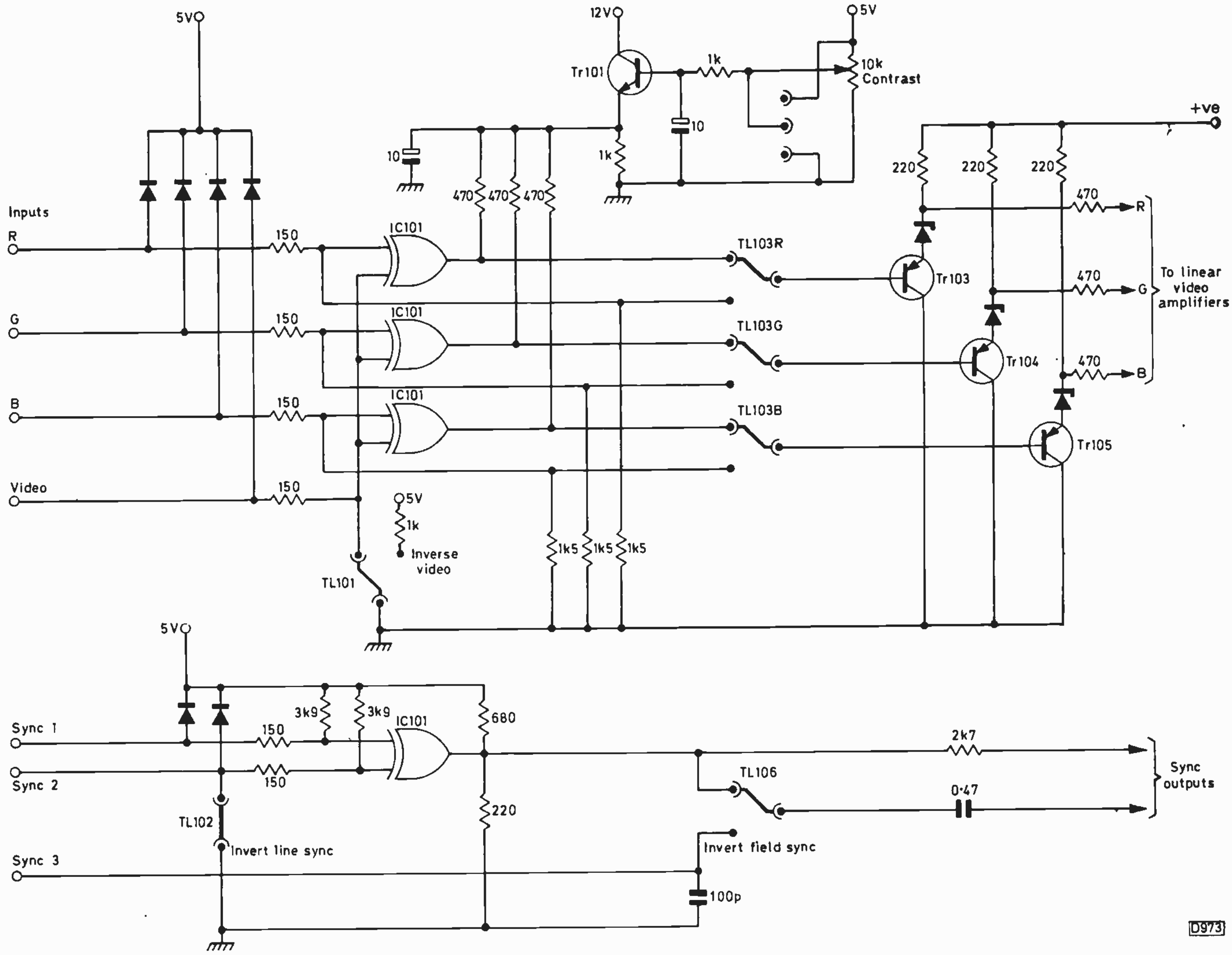


Fig. 15: Representative computer monitor video input circuitry. TTL or linear operation is selected by means of links TL103R/G/B. The exclusive-OR gates in IC101 invert the video pulses when link TL101 is changed and the line sync pulses when TL102 is present. Transistor Tr101 forms the upper leg of a resistive attenuator for contrast control in the TTL mode. Tr103/4/5 and the accompanying zener diodes provide level-shifting and temperature compensation.

provide these eight colours. Some computers, i.e. the Amstrad 464, have two levels of drive for each RGB output. These extra levels give a total of 27 colours. Other sources offer Y plus RGB outputs, with the separate Y signal setting the brightness of each colour, typically with two levels to give 16 colours (WYCGMRBB plus eight half tones). The Acorn Electron, BBC B and Commodore 64 provide 16 colours in this way. The Sinclair Spectrum is unusual in having YUV access only, so that an interfacing circuit is required to convert to RGB drive. Some commercial monitors (e.g. the Microvitec 1431/MZ) have a suitable converter built in. Alternatively an interface unit can be made up – see for example John de Rivaz's article in the July issue.

Sockets

There are several standards for monitor input signal levels and a wide variety of socket types. For professional monitors in analogue applications the BNC socket is most popular, usually with looped-through outputs to corresponding BNC output sockets. DIN and BNC sockets are used on TV receiver/monitors and I've come across phono socket inputs on small monochrome monitors. Professional data monitors are often fitted with a Cannon 9-pin D-type socket, while commercial monitors for home computers tend to use a standard 6- or 7-pin 240° DIN socket. What's important here is to ensure that you have the correct connecting lead to link computer and monitor! Monitor manufacturers are very helpful in this area. Finally the SCART socket is making a welcome appearance on all types of AV equipment.

Inputs

Regarding input signals for monitors, the standards that have been established are as follows.

(1) Composite video. Video signal plus sync (7:3 ratio), 1V peak-to-peak at 75Ω. This applies to most monochrome monitors.

(2) CVBS. Input signal encoded to the PAL or other standard. Vision/sync/burst ratio 7:3:3, total 1V p-p at 75Ω.

(3) RGB-linear. Separate wideband analogue inputs for R, G and B at 1V/75Ω. A separate composite sync input is usually provided, looking for sync pulses of between 1V and 8V peak. Positive or negative sync is in most cases catered for by means of a rear-mounted switch or movable links. Some monitors will accept sync with the analogue input (called composite RGB) in which case the sync pulses are generally taken from the G channel. For data and graphics display in this mode, 1V corresponds to on and 0·3V to off, as opposed to TTL-linear.

The above three analogue standards are usually acceptable within an amplitude tolerance of ±6dB.

(4) RGB-TTL. This is the most common mode for computer operation. The separate RGB inputs are designed to take TTL pulses (0V off, 5V on, into 1kΩ or 1·5kΩ) direct from the output pins of a character generator chip. In practice the computer's outputs have interfacing buffer stages to protect the chip. To eliminate hash, computer noise or possible shading effects, the monitor's RGB amplifiers (now operating in effect as switches) change state at about 1V, input level variations above this threshold having no effect on the brightness level. An input circuit operating in this way is shown in Fig. 15. It's important to remember that this "switched" RGB mode can offer only eight colours (including white and black), and that for 16 or more colour displays recourse must be made to RGB-linear inputs.

(5) TTL-linear. This mode permits brightness control by the computer. It has the 5V for white capability of the RGB-TTL mode but no two-state threshold switch.

VCR Clinic

Reports from Steve Beeching, T. Eng., Derek Snelling, Philip Blundell, Eng. Tech., Les Harris, John Coombes and Dewi James

Toshiba V9600

After replacing some prematurely worn video heads on a Toshiba V9600 (not an uncommon occurrence) and an upper drum cylinder I noticed that the head drum still rotated after stop had been selected. This explained why the heads had worn to a frazzle. I suppose that when the customer stopped the machine and left it the heads just kept on going. The capstan motor did too. There was no tape transport as the pinch roller was off. Attention was directed to the systems control section and it transpired that whilst motor control pin 7 of the microcomputer chip IC601 went from high to low when play was selected it didn't go back to high when stop was selected. The chip (TMP4320P-6202) was changed to the satisfaction of all concerned.

A point worth noting is the video head heights. When the tracking control was rotated the f.m. replay levels from the two heads rose and fell in opposite directions with the test tape. This results in a noisy picture. Head height adjustment is very critical and should not be attempted without experience. On some occasions it's given extended head life to a V9600 where poor picture has been due to differential heights and not just wear. **S.B.**

Grundig 2 × 4 Super

A Grundig 2 × 4 Super produced very spotty pictures when monitored in the record mode. Unfortunately we changed the tuner before we discovered that the trouble was due to the i.f. preamplifier transistor TR2302 (BF324) in the i.f. can. **S.B.**

Sony C7

Andy was singing a variation on "We'll meet again some SONY day" as he carried in a C7 from Geoff. It needed – no, not a rewind kit – new heads. After fitting the heads replay was interrupted by much muting of the sort usually caused by tape edge damage. This time the cause was a worn control track head. So a new audio/control track unit was fitted – personally I'd have preferred to fit just the head itself rather than half a machine. **S.B.**

Ferguson 3V29/3V30

A few cases of failure to erase the sound on Ferguson 3V29/30s have come in recently. In three machines this was due to the wires that go into the plug on the erase head. Crimped connectors are used, and the wires fell out with a gentle pull. In two cases the trouble was due to dry-joints where the small PCB solders on to the erase head.

Another problem that's beginning to show on these machines is failure to complete loading. The arms load fully but the mechanism doesn't operate enough to close the after-load switch. This is caused by the loading belt. **D.S.**

Hitachi Eject Mechanism

Here's a problem you may get with the eject mechanism on certain Hitachi models. On some of these the eject is damped by a hydraulic clutch. If the VCR is kept in a warm position the oil in the clutch tends to thin and run out, with the result that after about twelve months the cassette housing comes up like a rocket. I've had this on a VT11 and a VT9500 so far. The clutch is sealed and thus has to be replaced. **D.S.**

Sanyo VTC5150

The fault on this machine was no colour on playback. A burst with the hairdryer and freezer proved that IC1009 (M51439P) was heat sensitive, but a replacement was just the same. When the fault was present there was no chroma signal at pin 27 (TP1016). Voltage checks were next made around the i.c., the only discrepancy being at pin 26. When the resistor connected to this pin (R1297, 12kΩ) was checked it was found to be high in value at some 40kΩ. **P.B.**

Ferguson 3V35

A rather unusual fault came my way recently on a Ferguson 3V35. The problem was no playback, though E-E and record worked satisfactorily. We took the machine to the workshop and removed the top so that tests could be carried out. A quick check showed that the fault was still present. I decided to check the playback 9V supply: the transistor that switches this is on the luminance/chrominance board, which is mounted upside down at the top of the machine, over the video heads. Because of its position and the presence of ventilation holes directly over the board dust tends to gather here. This one was thick with it. A paintbrush was used to clear the dust so that the relevant transistor could be located when lo and behold the fault disappeared. No dry-joints could be found, and anyway the board hadn't been tapped, just brushed. I can only conclude that some of the fluff or dust was of a conductive nature – the machine's been back with the customer now for some three weeks with no recurrence of the problem. **D.S.**

Hitachi VT33E

This machine would work in all modes except fast forward. After making a few checks I decided to change the systems control board to speed up diagnosis. This made no difference however. The capstan/reel drive i.c. is on the power supply panel, and on changing this one the fault went. Three data lines go to pins 10, 11 and 12 of the capstan drive i.c. (M545484): 11 and 12 were shorted together due to a solder short under PG112. **L.H.**

Ferguson 3V31

This machine would run all right for about twenty five minutes on playback. Its drum speed would then increase. This was traced to the μPC1458 dual operational amplifier i.c. (IC13) – pin 7 went high in the fault condition. **L.H.**

Toshiba V8600

A V8600 came in from one of the branches with the complaint that playback of prerecorded tapes was o.k. but a noisy picture was produced when its own recordings were replayed. I decided to check around IC401 (TA7637P) which contains the f.m. modulator (amongst other things). As the f.m. waveform (TP202) was crushed the i.c. was replaced, but this made no difference. The f.m. comes out at pin 30, and on making some voltage checks there was found to be a 2V difference between pin 30 and TP202. R400 which links these points was 1kΩ instead of 100Ω. **L.H.**

Toshiba V8600

A couple of faults we've had with this machine. Picture jumping in the record, playback and still modes has been caused by the TM4217P servo i.c. (IC501). If the on indicator is not alight or flashes on and off check R816 (15Ω) which may be intermittent or open-circuit. **J.C.**

Sanyo VTC5300

In the event of failure to load or unload, try moving the guide ring. If this produces the required action replace the loading belt. **J.C.**

See also page 607, September – *Editor.*

Toshiba V9600

Problems we've had with this machine have been as follows.

No results: Check fuse F804 (500mAT). The fuse can blow due to transients on the power supply. This usually happens with the machine in the standby mode.

Luminance smearing: Check IC201 (TA7637P) by replacement.

Smearing on playback: Check IC104 (TA7636) by replacement.

Ejects cassettes: Check the cassette in switch S651 on the loading unit. If the switch is all right check whether the spring has dropped off the switch lever. The lever sometimes cracks.

No colour on playback: Check the pilot burst removal i.c. (IC206, TA7347P).

No rewind or slow rewind: Check the rewind idler assembly. The idler wheel can be changed on its own but it's best to replace the idler clutch assembly complete.

Capstan running at full speed: Check crystal X961 (2·968MHz) on the servo clock panel (U961).

No line lock: Check the adjustment of T961 on the servo clock panel (U961). Adjust for a stable picture on reverse search.

All function lights on, cassette loading and unloading automatically: Check the voltages around the microcomputer i.c. (IC601). If o.k. check the clock frequency (455kHz) at pins 24/5. If this is missing replace the ceramic resonator (Z601). **J.C.**

Mitsubishi HS303

We've had the following faults on this model.

For tape looping, no cue or review, poor rewind or a noise bar on the screen check for a faulty reel motor.

In the event of no record, playback all right, check the carrier set trimmer VC2B0 (50pF) in the f.m. modulator circuit (Y/C panel) by replacement – it can go high impedance.

If the drum speed is unlocked and the capstan speed varies, check IC4A0 (AN6350) by replacement.

If the capstan runs fast and won't switch off, check the waveform at pin 7 of IC4A1 (AN6341N). If this is missing, replace the i.c. If not, check the capstan drive transistor Q4A3 (2SC2603).

For displaced colour/cogging/intermittent snowy picture in the playback mode check for a squarewave at pin 25 of IC4A0. If this is missing check back to pins 9/10 of IC4A6 (TC4066BP), then pin 11, pin 7 of plug/socket VH and back to the junction of diodes D601/2. Next check that the 4·43MHz oscillator is producing an output (TP6N) – check with a frequency counter at pin 3 of IC603 (AN6342N). Trouble here is likely to be due to the 4·43MHz crystal (X601). Trimmer VC601 (45pF) is also suspect. **J.C.**

Sony C7

These machines tend to blank off the sound and vision when playing back their own recordings – the problem can occur at the beginning, end or middle of the tape and is due to slight wear on the control head and perhaps insufficient control head amplifier gain. To improve matters the gain of the control amplifier (AS3 board) can be increased by changing the value of R123 from 1·5kΩ to 2·7kΩ and replacing D30 with a 180Ω resistor.

Channel display stuck on ch. 18 was traced to gate chip IC7 on the timer board. **D.J.**

Hitachi VT19

We've had a few cases where the counter display clears itself in the fast forward and rewind modes. This is due to the microcomputer i.c. IC2010 which should be replaced (type HD38805A27). **D.J.**

Panasonic NV370

The problem we had with one of these machines was that it went into fast forward when the play button was pressed and into fast rewind when record was selected. There was also no eject. The culprit was C6011 on the syscon board – it was open-circuit. **D.J.**

Letters

THE IPSALO-2 CIRCUIT

I was particularly interested in the description of the Ipsalo-2 circuit in the September issue. Its principle of operation is covered by British Patent Specification number 1 502 074 which was filed in April 1976. This patent was the result of further development work following an earlier patent, the work being carried out whilst I was working at Texas Instruments Ltd. in the early 70s. It's interesting to note the effect of time on design objectives. The earlier patent minimised the number of then high-cost power semiconductors while the later one minimised the use of by then high-cost wound components and had to provide mains isolation.

From the designer's point of view the system has several advantages over the more common arrangement with separate switch-mode power supply and line output stages. Only one transformer instead of two is required, and in addition high leakage inductance (wide spacing) is necessary between the primary and secondary windings for good isolation. Energy is transferred to the deflection side of the circuit during the flyback, resulting in a longer efficiency diode conduction time and hence better scanning linearity.

Eight years is a long time in the television industry, and it's gratifying to find that even after such a time Salora considers the idea worth putting into production. What happened to the earlier patent? That one lapsed some years ago but lives on in service engineers' memories not as a number but in the name Syclops!
M.J. Maytum,
Willington, Bedford.

THORN TX9 CHASSIS

In reply to the query raised by Robin D. Smith in the September issue (TV Fault Finding, page 594), D66 is not required on the PC1040 main panel (TX9 chassis) due to the revised circuitry around the mains rectifier thyristor. With the later circuit configuration D67 also carries out the function previously performed by W66, i.e. preventing the thyristor's protection capacitor C142 affecting the zero crossing point of the rectified mains.
John Jameson, Technical Publications,
Thorn EMI Ferguson Ltd., Enfield.

MUSIC CENTRES

I'm prompted to write to you following the mention in Les's column (June) of premature failure of SN76003 i.c.s and their replacement, after appropriate circuit modifications, with SN76023s. I too used to have this problem with what I assume is the same chassis (Fidelity). There seem to be three failure modes with these units. (1) Customer induced, due to lengthening the speaker leads and shorting them out. (2) Excessive h.t. voltage. (3) Customers again, unplugging and replacing the speaker plugs with the unit switched on.

There's not much one can do about the first problem except replace the i.c.s and tell the owner not to do it again, but it's a good opportunity to carry out the modifications described below. The problem of excessive h.t. is easily put right though I find the reason for it inexplicable. There are two ways to reduce the h.t., which can be anything up to 32V – 28V is common – instead of the 24V specified. One is to insert a dropper resistor in the lead from the transformer's secondary winding – about 15Ω, wirewound works well. It's far easier to unwind a layer of turns from the secondary winding however. Fortunately it's easy to get at, doesn't take more than a few minutes to do and works well. The third problem, with the speaker plugs, can (other than not doing it!) be cured by adding a 1k-2·2kΩ resistor across each speaker socket, inside the case. This has negligible effect in normal use compared to the 8Ω or so of the speaker but prevents the coupling capacitor charging so quickly when the speaker is plugged in that the i.c. is destroyed. It takes only a minute, and prevents bouncers – particularly as most customers will never admit to having done it in the first place, which can lead to an embarrassing argument. This last modification is also well worthwhile with Stereosound music centres using TDA2611 i.c.s.

Fidelity chassis often use a cluster of components to deliver 12·5V to the preamplifier stages. These components often cause problems. An uprated transistor will help, but a once and for all solution is to fit a 12V i.c. voltage stabiliser (50p from Sendz) and ditch all the other bits. I keep meaning to try one of these in a Ferguson 3816 (1590 chassis). A 6V voltage stabiliser is a very worthwhile addition to those green and yellow Philips clock radios: it makes such a vast improvement that one wonders why they were not fitted in the first place – but of course they were not invented then!

None of this has much to do with TV, but I would guess that most engineers get involved in these related fields from time to time and may well do so more often as TV sets become more reliable.
Alan J. Gamble,
Ormskirk, Lancs.

HEATHKIT GR9900

There seems to be considerable difficulty in obtaining i.c.s for use in the Heathkit GR9900 12in. monochrome portable – in particular the SN76001 which was used in the audio and field output positions. There appear to have been several versions of this i.c., the type required having heatsink tabs. One faulty chip I have is labelled SNX76001ND which no one seems to have heard of. Have other readers had to replace these i.c.s? Have they any suggestions about what to use?
Dr. R.C. Armstrong, FZS,
Holme-on-Spalding-Moor, York.

COMPONENT TESTER

In the letters page last month Dr. Rankin described a modification to the component tester to reduce the X output. The simplest way to do this is to use a switch as

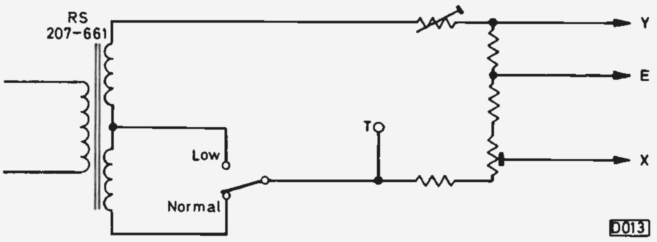


Fig. 1: Suggested method of reducing the output voltage provided by the component tester.

shown in Fig. 1. This will also reduce the Y output, but nevertheless works well. Dr. Rankin's method would appear to be perfectly satisfactory. Normally however it shouldn't be necessary to reduce the output. I've used and tested the unit with a wide variety of scopes, including the Telequipment D61. Large numbers of workshops use this model, which is one of the best service scopes around. Variations did occur with the D61 – some for example had 5mm sockets instead of BNC inputs – and this might account for Dr. Rankin's experience. It's important to use the correct RS mains transformer as a slight increase in the a.c. output voltage could cause problems.

I hope other users are obtaining good results with their component testers.

David Botto,
Bournemouth, Dorset.

SOUND TROUBLES

Sorry to disagree with Les Lawry-Johns (October issue) but the volume control in the Decca 30 series chassis is 50kΩ linear. I find it puzzling that the sound came up loud and clear with the wrong type fitted. Also Nick Lyons mentions trouble with the PCL86 used in the ITT CVC8 chassis. Wouldn't it have been simpler to change this 90p valve in the first place rather than pay repeated visits to the set?

C.P. Bird,
Selby, N. Yorks.

Editorial note: Sorry for the confusion. It was a 1730, not an 1830. The 1730, as with the earlier 10 series chassis, uses a 500kΩ semi-log volume control. The 1830 and other 30 series sets use a 50kΩ linear volume control with other changes in the coupling network between the intercarrier sound i.c. and the PCL82.

WORTH NOTING

A couple of problems I've had recently may be of interest to other readers. The first concerned a GEC 3133 monochrome portable with start-up problems – it's the set with the "switch mode pump" circuit. The trouble was traced to the boost diode D205 (BYX55/300) which was short-circuit, holding down the start-up supply. The second problem was with a Decca colour set fitted with the 90 series chassis. Due to severe internal flashover a new tube and a new beam cut-off transistor (Tr213) had to be fitted. Result – no picture but a blank raster with flyback lines when the first anode preset was advanced. Two days later I discovered that the PC board printing for the connections to Tr213 was the wrong way round. Naughty that!

C.A. Jackson,
Sutton-on-Forest, York.

MODEL NUMBERS

I find the servicing articles in your magazine most helpful but there's one big difficulty – relating the chassis types you always quote to the set on the bench, which often has a model number and nothing else. A case in point is the Grundig GSC100 and GSC200 chassis dealt with in the September issue. Couldn't you publish some tables of model numbers linked to chassis, as Thorn do from time to time in *Ferguson Feedback?*

Thanks anyway for all the gen – I always read Les before all else! Incidentally I'd like to find good homes for

the following: G6 not working, Pye hybrid working, several 405-line sets some working, 405-line signal generators, many reel-to-reel tape recorders and lots of junk – mostly free to callers.

E.J. Gordon Madgwick,
Thursdays, Whitmore Vale,
Hindhead, Surrey GU26 6JA.

Editor's comment: Most manufacturers produce a few basic chassis which are used in large numbers of different sets, hence our use of chassis type numbers for identification. To tabulate models would in some cases be difficult without going into other aspects such as control and tuning arrangements etc. For the record the GSC100 was used in Models 1514GB, 4415GB, 6215GB, 6415GB and 6615GB; the GSC200 was used in Models 1644GB, 1645GB, 4245GB, 4445GB, 6245GB and 6445GB.

MORE ON PLUGTOPS

I read with interest the letter from C.A. Burrows concerning burning of the neutral pin in mains plugs – also previous letters commenting that the neutral pin seems to undo itself. May I suggest that the reason for these effects is simply electron flow? Remember that electrons flow from negative to positive. One doesn't get a shock from the neutral side of the supply because one's already charged to this potential – it's the potential difference at the positive side that draws current and gives you a shock.

Wasn't it a gentleman named Ampere who said that current flows from positive to negative? We now know better!

Rothley Stevens, Radio and Television,
Coventry.

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ESM532C	4.18	LM1303P/N	1.58	MPSU05	0.78	SAA5010	4.90	SN74190	1.81	T6029V	4.41	TBA395	1.35	TDA1230	2.93	TDA9503	2.80
ESM632C	4.18	LM1310P/N	1.25	MPSU10	0.78	SAA5012	6.50	SN7420N	0.30	T6032V	0.89	TBA395Q	1.80	TDA1235	3.52	TDA9513	2.40
ESM732C	4.18	LM3085N	0.77	MPSU55	0.90	SAA5020	5.25	SN7430	0.28	T6033V	0.73	TBA396	1.80	TDA1270	2.84	TE527	1.25
ETT6016	2.05	LM317CKC	1.38	MPSU56	0.30	SAA5030	7.50	SN7440N	0.24	T6035V	0.86	TBA400	2.17	TDA1327A	1.05	TE538	0.36
ETTR6016	2.16	LM339N	0.88	MPSU60	1.20	SAA5040A	14.75	SN7473	0.56	T6036	0.44	TBA440P	1.55	TDA1327B	1.05	TE626	1.35
FND500	5.25	LM3407	1.29	MR510	0.30	SAA5050	8.50	SN7474N	0.72	T6037	1.91	TBA480	1.42	TDA1330	1.80	TEA1002	3.15
FT3055	1.05	LM340T5	0.75	MR812	0.80	SAA661B	1.80	SN7490AN	0.93	T6041V	0.86	TBA480Q	1.67	TDA1365	6.35	TDA1009	0.96
GF758	0.82	LM340T12	0.75	MR914	0.46	SAA700	3.80	SN75110N	0.75	T6044V	0.86	TBA500PQ	4.95	TDA1412	0.95	TEA1020SP	5.34
GF759	1.82	LM340T5	0.75	MSSD7002	0.65	SAB1009B	4.53	SN76001ANQ	2.25	T6045	1.09	TBA510	1.55	TDA1420	1.48	TEA1087	0.46
GF761	0.78	LM342N	0.56	MVS240	0.52	SAB1046P	3.06	SN76003N	2.81	T6049	1.10	TBA510S	6.39	TDA1470	2.63	TIC106C	0.55
GH3F	1.05	LM384N01	1.84	MVS460	0.30	SAB3011	7.34	SN76013N	3.63	T6052V	0.76	TBA520	1.67	TDA1512	2.20	TIC106M	0.55
HA11211	2.30	LM567CN	1.30	MVS460-02	0.55	SAB3012	5.34	SN76013ND	2.25	T6058	0.46	TBA520Q	1.35	TDA1670	3.65	TIC116D	0.80
HA11215	4.80	LM748	1.85	ME545B	2.95	SAB3013	3.20	SN76013NDG	8.87	T6059	1.05	TBA530	0.86	TDA1770	5.56	TIC44	0.65
HA11225	3.90	LM6380	2.70	ME545B	3.80	SAB3021	7.18	SN76023N	2.35	T8001V	1.09	TBA530Q	0.85	TDA1905	1.25	TIC45	0.70
HA11226	7.58	LM6361	2.78	ME5534N	1.48	SAB3022B	12.34	SN76023ND	1.84	T9003V	0.86	TBA540	0.98	TDA1908	2.95	TIC47	0.70
HA11229	2.51	M1024	2.55	ME555	0.34	SAB3023B	11.18	SN76033N	2.33	T9005V	2.16	TBA540Q	1.15	TDA1910	2.30	TIP120	0.96
HA11235	3.80	M1025	4.70	ME556	0.75	SAB3024	4.77	SN76105N	2.36	T9010V	0.87	TBA550	1.95	TDA1940	2.54	TIP110	0.48
HA1124	4.70	M1124	2.54	ME5560N	3.16	SAB3209	4.75	SN76110N	1.13	T9011V	1.27	TBA550Q	2.25	TDA1950	2.54	TIP112	0.80
HA11244	4.32	M1130	4.06	ME565N	1.20	SAB3210	2.93	SN76115AN	1.46	T9013V	5.81	TBA560C	0.86	TDA2002	1.20	TIP117	0.86
HA1125	3.90	M191	5.74	ME645BN	3.80	SAB4209	12.75	SN76131	1.74	T9014V	1.52	TBA560CQ	1.15	TDA2003	1.05	TIP120	0.73
HA11251	3.38	M193	18.55	ME646N	3.80	SAF1031	2.30	SN76226DN	1.20	T9016	0.92	TBA570	1.55	TDA2004	2.52	TIP121	1.08
HA1137W	2.57	M51102L	4.82	ME650N	3.94	SAF1032	5.80	SN76227N	0.80	T9022N	0.39	TBA570A	1.55	TDA2006	1.25	TIP126	0.96
HA1138	3.56	M5115P	4.34	ME645BN	3.80	SAF1039	11.06	SN76228N	2.97	T9034V	1.25	TBA570Q	1.35	TDA2010	2.79	TIP127	1.38
HA11414	2.58	M51231P	2.79	MP1106	4.80	SAS5010	7.82	SN76231	2.31	T9035V	1.26	TBA625A	1.97	TDA2020	2.75	TIP2955	0.78
HA1144	6.38	M5124P	4.38	OA200	0.10	SAS560	1.80	SN76242	4.75	T9038V	6.15	TBA625B	1.97	TDA2030	1.65	TIP29A	0.41
HA1156	1.23	M5134-9341	3.75	OA202	0.10	SAS560S	2.97	SN76243	4.75	T9051	2.55	TBA625C	1.97	TDA2140	1.44	TIP29B	0.57
HA11580	7.80	M51394P	6.25	OA47	0.10	SAS560T	2.85	SN76322	2.51	T9053V	1.83	TBA641A12	3.75	TDA2150	5.63	TIP29C	0.40
HA1180	3.45	M5142P	4.38	OA90	0.07	SAS570	1.61	SN76360	1.97	T9054V	0.92	TBA641BX1	2.07	TDA2151	1.75	TIP3055	0.65
HA1166	3.80	M5143P	6.86	OA91	0.80	SAS570S	0.80	SN76390	2.80	T9057V	0.83	TBA651	1.80	TDA2160	3.84	TIP30A	0.41
HA1167	5.13	M5144P	3.42	OA95	0.80	SAS570T	2.50	SN76396	2.63	T9063V	2.94	TBA673	2.35	TDA2161	1.80	TIP30B	0.63
HA11711	16.13	M51513L	2.06	OC28	0.96	SAS580	4.41	SN76510N	0.95	TA5814	1.35	TBA700Q	2.19	TDA2190	3.11	TIP31B	0.35
HA11713	6.70	M51515BL	3.10	OC29	1.95	SAS5800	2.82	SN76530P	1.90	TA7020P	4.36	TBA720	2.85	TDA2510	1.82	TIP31C	0.63
HA11714	7.85	M51516L	3.40	OC35	0.96	SAS590	4.55	SN76532N	1.80	TA7027	4.36	TBA730	1.75	TDA2520	2.15	TIP32B	0.35
HA11715	7.85	M51517L	2.90	OC36	1.16	SAS5900	2.32	SN76533N	1.56	TA7050	1.58	TBA750Q	1.46	TDA2521	2.15	TIP32C	0.86
HA11718	6.79	M5152L	1.00	OC44	0.40	SAS660	2.50	SN76540N	1.80	TA7051	1.58	TBA760	1.55	TDA2522	2.81	TIP33C	1.25
HA11724	15.80	M51522	4.90	OC45	0.40	SAS6600	1.20	SN76544	1.80	TA7060AP	0.80	TBA780	3.80	TDA2523	2.75	TIP34	1.07
HA11725	16.80	M5191P	4.49	OC75	0.40	SAS660S	1.20	SN76545	4.55	TA7061AP	0.78	TBA800	0.80	TDA2524	4.50	TIP41A	0.39
HA1180	4.80	M5192	2.80	ON188	1.70	SAS6610	1.20	SN76546	3.15	TA7069	2.84	TBA810AS	1.46	TDA2525	2.96	TIP41B	0.20
HA1203	1.56	M53273P	0.92	ON236	2.90	SAS670	2.50	SN76546N	3.15	TA7070P	1.52	TBA810S	1.46	TDA2530	2.19	TIP41C	0.44
HA1306	1.74	M53274P	1.20	OT112	0.90	SAS6700	1.20	SN76549	2.35	TA7071	3.35	TBA810T	1.46	TDA2532	2.51	TIP42A	0.39
HA1322	1.74	MA06	0.97	OT121	0.78	SAS670S	1.20	SN76550	0.30	TA7072P	1.35	TBA820	0.83	TDA2533	2.09	TIP42B	0.71
HA1339	1.76	MA8001	0.74	PD144	2.83	SAS6710	1.20	SN76551	1.35	TA7073P	4.05	TBA820M	1.05	TDA2540	1.95	TIP42C	0.44
HA1342	1.80	MB3705	1.82	PT1017	2.43	SAS6800	2.30	SN76570	2.80	TA7074P	1.95	TBA890	1.05	TDA2541	1.95	TIP47	0.65
HA1350	2.97	MB3712	2.85	PT2014	2.76	SAS6810	1.30	SN76600	1.10	TA7076P	4.95	TBA900	2.25	TDA2545Q	3.16	TIP48	0.63
HA1365	3.05	MB3713	1.38	PT8042	1.82	SBA550B	1.95	SN76611	2.35	TA7089N	1.41	TBA920	1.50	TDA2560	1.97	TIP49	3.20
HA1366WR	1.82	MB3730	2.94	R1038	1.99	SBA750	1.46	SN76620	2.35	TA7089P	1.36	TBA920Q	2.10	TDA2571A	2.81	TIS43	1.21
HA1367	3.20	MC13002	4.86	R1039	1.99	SC9488P	1.90	SN76622	1.50	TA7092P	3.85	TBA940	1.70	TDA2575A	2.95	TIS90	0.22
HA1368	1.80	MC1303P	1.96	R2008B	1.20	SC9503	1.50	SN76623	0.62	TA7093P	1.64	TBA950	1.55	TDA2576A	2.58	TIS91	0.26
HA1368R	1.86	MC1307P	1.90	R2009	1.20	SC9504P	1.46	SN76630	2.31	TA7102P	5.34	TBA970	2.80	TDA2577	5.31	TL071CP	2.02
HA1370	2.97	MC1310P	1.25	R2001B	1.20	SC9511P	1.90	SN76640	3.85	TA7108P	1.40	TBA970Q	2.98	TDA2581	1.95	TMS1000NL	10.78
HA1377	2.80	MC1327P	1.20	R2029	1.20	SCR957	1.20	SN76650N	1.24	TA7109	3.37	TBA990	1.05	TDA2582	1.98	TMS3748NS	11.06
HA1389	1.82	MC1330P	1.23	R2030	1.20	SG264A	4.38	SN76651	1.35	TA7120P	0.58	TBA990Q	1.95	TDA2590	2.80	TMS4116	1.07
HA1389R	1.74	MC1349P	1.20	R2257	2.16	SG613	7.80	SN76660N	2.25	TA7122B/P	0.54	TBA231	2.33	TDA2591	2.80	TV106	1.20
HA1392	2.80	MC1350P	1.10	R2265	1.95	SG629	6.28	SN76665N	1.35	TA7124P	2.80	TC4001	1.29	TDA2591Q	2.80	TY6010B	2.70
HA1397	2.97	MC1351P	0.75	R2305	1.07	SG6533	9.37	SN76666N	0.90	TA7130P	1.15	TC4053BP	3.94	TDA2593	2.24	U05G	1.83
HA1398	2.80	MC1352P	1.01	R2306	1.23	SI-1020N	4.76	SN76705	3.38	TA7136AP	1.15	TCA150	1.82	TDA2594	2.80	U143M	2.80
HA1406	1.80	MC1357P	1.95	R2322	1.26	SI-1125HD	10.70	SN76705N	3.99	TA7137P	0.85	TCA160B	1.82	TDA2600	5.80	U3700	0.55
HA17723	5.40	MC1358P	1.55	R2323	1.23	SI-1130N	6.30	SN76707N	3.99	TA7141AP	3.51	TCA270Q	1.55	TDA2610	2.53	U37003	0.44
HBF4030AF	2.25	MC14001	7.15	R2348	1.82	SKB2/08	0.70	SN76709	4.65	TA7146P	8.04	TCA270S	1.95	TDA2611A	1.25	UA723CA	5.82
HD4480	15.80	MC14011	0.23	R2354A	1.82	SKE2F 1/04	1.26	SN76709N	4.95	TA7148P	1.51	TCA270SQ	1.85	TDA2611AQ	2.55	UA758PC	3.06
HD44801A05	15.90	MC14013	0.37	R2354B	1.82	SKE2G 2/04	0.95	SN76730	4.23	TA7149P	2.10	TCA290A	2.06	TDA2612Q	4.25	UA783P3C	1.07
HM6231	8.50	MC14016CP	0.37	R2441	1.23	SKE2G 3/04	0.95	SN76810N	0.62	TA7153P	4.53	TCA420A	1.90	TDA2620	1.96	UAA170	2.14
HM6232	7.71	MC14025	0.54	R2443	0.80	SKE4F 1/02	1.26	SN76920N	2.63	TA7161P	5.06	TCA440	1.85	TDA2630	2.34	UAA180	2.14
HM9102	2.92	MC14049UBC	0.52	R2461	2.10	SKE4F 1/06	0.66	SN94041	3.45	TA7162P	4.25	TCA4500A	1.95	TDA2631	2.48	ULN2165	1.35
HM9104	2.94	MC1438R	0.95	R2477	0.92	SKE4F 2/06	2.10	SN94042	3.95	TA7169	4.80	TCA530	1.80	TDA2640	2.25	ULN2204	7.80
HT4207	15.80	MC14493P	2.56	R2501	1.16	SKE4F 2/06	0.80	SP8385	0.50	TA7171P	2.53	TCA640	2.63	TDA2643	6.93	ULN2216F	1.95
IS689	1.87	MC14510BAL	3.15	R2540	1.80	SKE4G 2/02	0.87	STA441C	2.27	TA7172P	1.20	TCA650	1.85	TDA2651	2.95	UPC1001H	2.50
IS751	1.87	MC14556BCP	3.15	R2540X	3.80	SKE5F 3/10	1.45	STK0029	3.42	TA7176P	2.25	TCA660B	2.63	TDA2652	7.05	UPC1009C	5.74
ITT2003	0.20	MC1712	3.52	R2615	0.80	SL1310	2.85	STK0039	4.80	TA7193P	4.44	TCA730	3.84	TDA2653	2.95	UPC1020H	2.12
K174YP	2.95	MC7724CP	3.17	RC4195NB	1.96	SL1327E	1.20	STK0050	4.96	TA7201P	3.25	TCA740	2.25	TDA2654	2.91	UPC1025H	2.49
KA2101	2.65	MC7818C	1.98	RCA16029	1.82	SL1430	1.26	STK0059	6.40	TA7202P	2.24	TCA750	1.75	TDA2655B	3.15	UPC1026C	1.24
KC581C	5.47	MC7824CP	4.25	RCA16083	4.81	SL1430T	2.10	STK0080	8.32	TA7203P	1.95	TCA760B	2.79	TDA2660	2.24	UPC1028H	0.90
KC582C	3.45	MC78M12	0.75	RCA16334	0.92	SL1432	2.25	STK011	3.06	TA7204P	1.95	TCA800	1.65	TDA2661	2.24	UPC1030H	2.06
KC583C	4.80	MC78M24	0.85	RCA16335	1.23	SL414	3.35	STK013	7.04	TA7205	1.25	TCA800Q	2.25	TDA2670	2.50	UPC1031H	8.05
L129V	1.78	MCR101	0.80	RCA16600	1.25	SL432A	3.12	STK014	7.14	TA7208P	1.95	TCA830S	1.94	TDA2670A	1.76	UPC1031H2	6.80
L200CV	1.80	MCR106/5	1.17	RCA16799	2.16	SL437	6.00	STK015	5.12	TA7210P	3.25	TCA900	1.85	TDA2680	2.30	UPC1032H	0.94
LA1111AP	0.80	MCR220/7	1.34	RCA16801	0.86	SL439	2.25	STK016	4.82	TA7214P	2.90	TCA910	1.50	TDA2690A	2.40	UPC1154H	1.75
LA1201	0.90	ME0402	0.27	RCA16802	0.98	SL480	5.00	STK022	4.77	TA7215P	2.09	TCA940E	1.88	TDA2780AQ	2.18	UPC1156H	1.45
LA1210	1.38	ME0404	0.23	RCA17028	2.25	SL490	1.78	STK025	7.20	TA7217AP	1.36	TCE330	3.53	TDA2790Q	5.92	UPC1181H	1.25
LA1320	1.46	ME0404/2	0.42	RCA17074	6.80	SL901B	6.88	STK040	7.09	TA7222	1.95	TCE527	1.37	TDA2791	2.50	UPC1182H	1.82
LA1352	1.40	ME0411	0.45	RCA17376	1.43	SL917B	7.95	STK043	7.09	TA7227P	1.89	TCE82	0.98	TDA2795	2.95	UPC1185H	2.94
LA1367N	5.90	ME0412	0.21	RCA60857	4.50	SL918A	5.83	STK054	6.40	TA7229P	4.10	TCE83	0.98	TDA2800	6.12	UPC1186H	0.95
LA1364	2.74	ME4102	0.45	RGP10	0.45	SN6848	8.82	STK070	20.28	TA7310P	1.95	TCE84	0.98	TDA3000T	2.31	UPC1212C	0.95
LA1365J	2.79	ME545B	9.10	RT402	1.40	SN16861N-07	1.59	STK077	7.00	TA7313AP	1.36	TCEP100	4.80	TDA3030A	10.44	UPC1213C	0.95
LA1385	1.70	ME6002	0.23	RT905A	2.00	SN16862N-07	1.88	STK078	5.52	TA7314	5.10	TCEP100Q	9.31	TDA3190	1.75	UPC1217C	2.24
LA1387	4.57	ME6102	0.45	S0280	1.94	SN16880N	3.30	STK082	7.54	TA7609	3.00	TD190	0.54	TDA3300B	7.75	UPC1350C	1.75
LA3155	0.90	ME8001	0.26	S0281	1.94	SN16985	8.13	STK086	9.90	TA7611AP	3.54	TD3F700H	6.00	TDA3500	5.95	UPC1351C	1.84
LA3300	1.40	MJ2501	4.95	S041P	1.26	SN16986N	5.49	STK2101	5.74	TA7676P	3.05	TD3F800H	2.25	TDA3501	10.99	UPC1353	6.75
LA3301	1.20	MJ2955	1.34	S042P	1.46	SN29715N	5.49	STK2110	6.66	TAA300	2.99	TD3F800R	3.21	TDA3506	10.12	UPC1360C	4.10
LA3350	1.30	MJ3000	2.15	S1299	4.30	SN29716N	3.32	STK2230	6.06	TAA310A	0.27	TD3F900H	3.78	TDA3510	5.95	UPC1362	7.95
LA3361	1.30	MJ3001	1.30	S175	18.95	SN29717N	6.53	STK415	6.04	TAA320A	1.15	TD3F900R36	3.78	TDA3520	8.82	UPC1365	5.79
LA4030P	2.37	MJ3028	2.40	S2062D	1.80	SN29722	10.65	STK433	9.35	TAA350A	1.82	TDA1001A	2.10	TDA3521	12.17	UPC1366	4.23
LA4031P	3.80	MJ481	1.39	S2800	5.25	SN29723AN	6.95	STK435	5.44	TAA435	1.65	TDA1003A	2.15	TDA3560	6.87	UPC1458	7.87
LA4032P	1.40	MJ802	4.95	S2800D	2.55	SN29744N	2.08	STK436	5.70	TAA550	0.33	TDA1004A	2.15	TDA3561	7.50	UPC2002	1.40
LA4050P	1.42	MJE2955	1.71	S2802	3.15	SN29764AN	3.30	STK437	8.10	TAA570	1.58	TDA1005A	2.15	TDA3571Q	2.25	UPC30C	2.22
LA4051P	1.82	MJE3055	0.78	S3702S	4.73	SN29767	3.61	STK439	6.26	TAA611B12	1.50	TDA1006A	2.15	TDA3571A	5.67	UPC32C	4.49
LA4100	1.82	MJE340	0.44	S3703F	4.73	SN29770AN	2.04	STK441	8.96	TAA621AX1	2.00	TDA1010	2.43	TDA3576	4.76	UPC41C	3.72
LA4101	1.18	MJE520	0.44	S3707	3.92	SN29771BN	4.23	STK443	9.35	TAA630S	3.31	TDA1011	2.80	TDA3950	2.81	UPC554C	1.88
LA4102	2.55	ML231	2.20	S40W	7.99	SN29772BN	4.21	STK459	6.56	TAA640	3.85	TDA1028	2.22	TDA3950B	1.40	UPC558C	3.87
LA4112	4.35	ML232B	3.30	S551	4.12	SN29773	2.20	STK460	5.78	TAA661B	1.59	TDA1029	4.44	TDA4050A	3.15	UPC566H	2.78
LA4125	2.46	ML237B	2.20	S552	4.12	SN29791	1.51	STK461	7.14	TAA700	2.35	TDA1034B	2.20	TDA4180P	1.74	UPC572	3.51
LA4138	2.80	ML238	4.82	S6080B	2.75	SN29798N	3.89	STK463	8.06	TAA840	2.27	TDA1035T	1.83	TDA4260	1.40	UPC575C2	3.72
LA4140	0.80	ML741CS	0.36	S6087AR	4.45	SN29845	2.14	STK465	7.32	TAA930	4.42	TDA1037	1.45	TDA4280	6.45	UPC576H	2.80
LA4192	2.80	ML923	2.18	SAA1020	4.32	SN29848	1.06	STK466	10.70	TAA970	2.57	TDA1041	1.96	TDA4290	4.86	UPC577H	0.84
LA4220	1.34	ML926	3.25	SAA1021	4.32	SN29861	2.80	STK501	5.74	TAD100	1.91	TDA1044	1.61	TDA440	1.95	UPC587C2	2.34
LA4400	2.04	MM5314N	3.72	SAA1024	2.55	SN29862	2.80	STK502	5.74	TAG232-600	0.86	TDA1047	2.14	TDA4400	2.06	UPC592H	1.02
LA4420	1.56	MM5315N	3.72	SAA1025	4.70	SN72709	0.40	STR441	6.34	TAG626-600	0.84	TDA1054M	1.10	TDA4420	4.25	UPD1514C	7.56
LA4422	1.56	MM5318N	2.82	SAA1050	3.78	SN7400N	0.24	STR453	6.75	TBA120	0.95	TDA1059B	0.98	TDA4422	5.63	UPD851	14.39
LA4430	1.40	MM5369N	1.82	SAA1051	5.30	SN7401N	0.24	STR6020	7.20	TBA120A	0.95	TDA1060	2.01	TDA4430	4.34	UPX27C	1.98
LA4460	1.92	MM5387AA/N	11.50	SAA1061	3.20	SN7402N	0.59	T6007V	0.89	TBA120AS	0.95	TDA1062	2.85	TDA4431	2.86	X0022CE	3.87
LA4461	2.80	MM5841N	5.90	SAA1075	4.41	SN7404N	0.21	T6007N	0.82	TBA120S	0.95	TDA1104	5.95	TDA4432	2.86	X0035TA	4.35
LA5112N	1.82	MP8112	1.35	SAA1082	8.04	SN7408N	0.24	T6016	0.36	TBA120SB	0.95	TDA1151	0.65	TDA4440	2.52	X0056CE	3.90
LA7020	6.86	MP8113	1.35	SAA1121	4.32	SN7410N	0.24	T6017	0.85	TBA120T	0.95	TDA1170	2.15	TDA4600	2.58	X0062CE	4.95
LA7025	7.31	MP8512	1.23	SAA1124	2.55	SN74121	1.20	T6018V	0.65	TBA120U	0.95	TDA1170S	1.85	TDA4610	2.42	X0065CE	3.48
LA7800	2.12	MPF256C	0.54	SAA1130	4.86	SN74122	0.95	T6021	0.36	TBA120UB	3.47	TDA1180	2.25	TDA4620	4.50	X0109CE	6.10
LA7801	3.80	MPS6570	0.43	SAA1174	5.75	SN7413N	0.33	T6022V	3.56	TBA1440	2.80	TDA1190	1.91	TDA5500	2.48	X1074AF	6.36
LD3120	1.20	MPSA42	0.59	SAA1250	3.78	SN74141	1.41	T6026	0.89	TBA1440G	3.48	TDA1190Z	2.25	TDA5600	2.88	XC949P	1.20
LM1011N	2.95	MPSA56	0.24	SAA1251	5.30	SN74151AN	1.51	T6027	0.73	TBA1441	1.59	TDA1200A	1.30	TDA5700	2.10	Y730	0.24
LM1017N	1.96	MPSA92	1.11	SAA5000	3.85	SN74154N	1.15	T6028V	0.35	TBA240A	3.42	TDA1220	2.25	TDA9403	2.90	Y969	0.80

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Remote Control for VCRs

Derek Snelling

Since the remote control systems used with VCRs rarely if ever seem to get mentioned in VCR Clinic I thought a short survey of such systems and some common faults would be of interest. The remote control systems used in VCRs fall into two categories, the wired type and infra-red ones. We'll look at the wired type first.

Wired Systems

The simplest are those with a screened lead and jack plug connection to the VCR. Examples are the Hitachi VT8000/VT8300/VT9300 and the Ferguson 3V29/3V30, plus the equivalents in other ranges. The one used in the VT8300 is typical: it consists of a thick-film resistor network in a ladder configuration, the various resistors being switched by push switches – see Fig. 1. At the VCR end the Hitachi and Ferguson systems differ slightly. With the VT8300 the remote control unit is simply connected in the line from the front panel switches to the command decoder i.e., in parallel with the panel switches. In the Ferguson 3V29/3V30 however the remote and front panel switches are connected to separate comparator/converters in IC3 before being combined to address the microcomputer IC2 – see Fig. 2.

The wired remote control units used with the Mitsubishi HS303, HS304 and early Panasonic NV7000s have multicore cables with DIN-like plugs to connect them to the VCR. The NV7000 unit consists of a duplicate of the front panel controls, i.e. a dozen switches and diodes arranged as a matrix, a simple system that unfortunately calls for eight connecting wires – see Fig. 3. The arrangement used with the HS304 is even simpler, containing just six switches and no diodes: it requires five connecting leads – see Fig. 4.

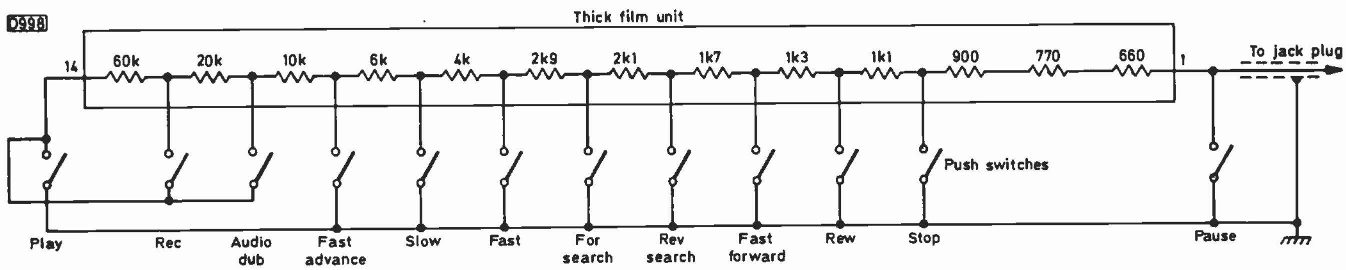


Fig. 1: Circuit of the Hitachi VT8300's remote control handset.

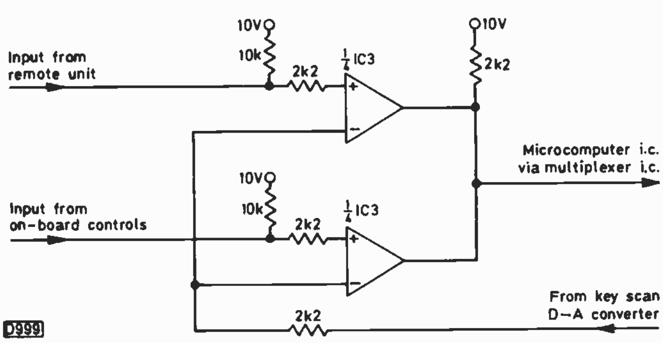


Fig. 2: Arrangement used in the Ferguson 3V29 to combine the remote and on-board control commands.

Faults

Faults with wired remote control systems are usually easy to trace. The Ferguson 3V29/3V30 arrangement is particularly unreliable. The plug is prone to disintegrate or, less obviously, to develop a crack around the outer conductor. The wire has a tendency to break or leak between the core and the screen – this latter fault causes

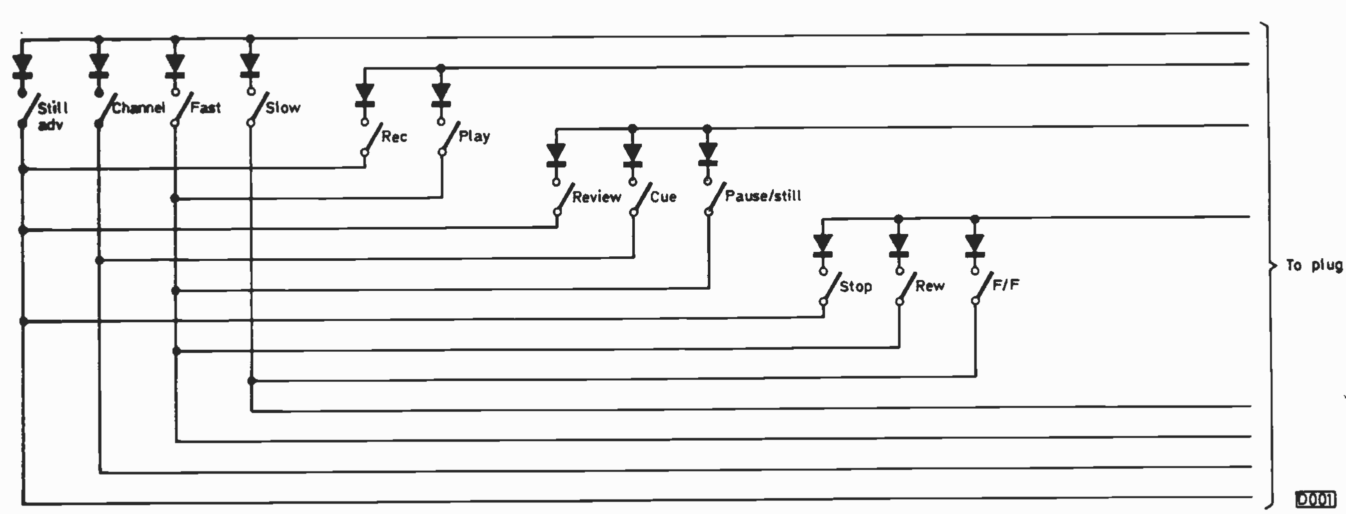


Fig. 3: Multicore cable remote control switch circuit used with the Panasonic NV7000.

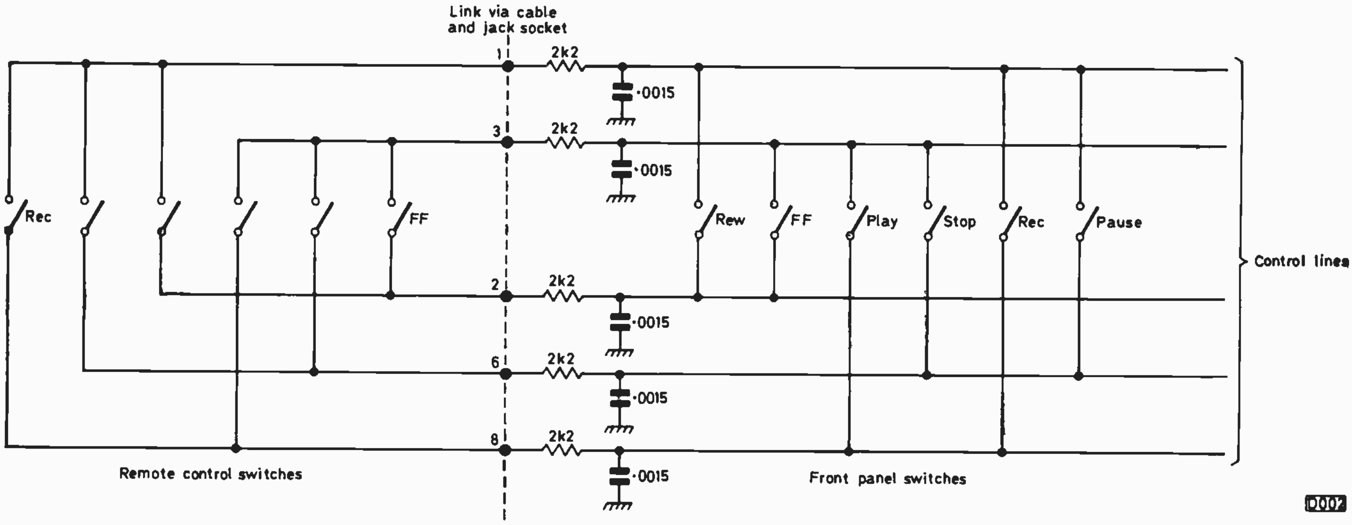


Fig. 4: Remote/on-board switching circuit, Mitsubishi Model HS304.

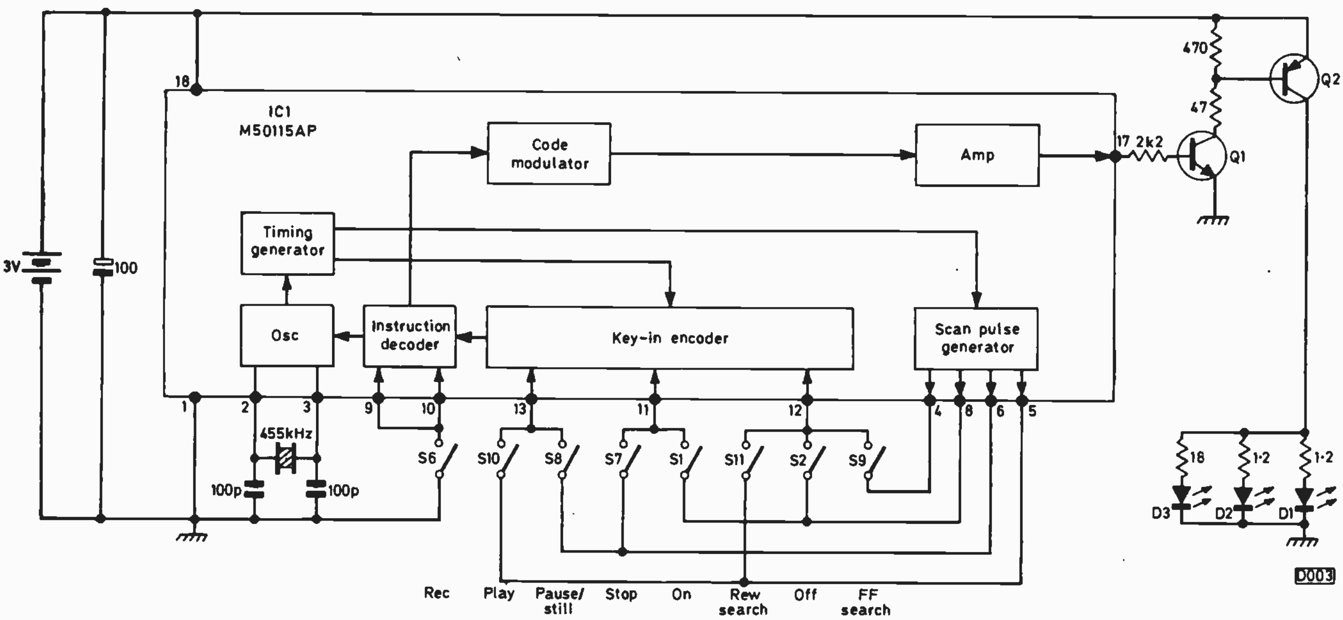


Fig. 5: Infra-red remote control transmitter circuit, Ferguson Models 3V35/3V36.

incorrect functions. Finally the switches themselves can go leaky. I've not as yet had a faulty thick-film resistor network.

I've had a few switch failures with the Hitachi units. Otherwise the system is reliable. With the Panasonic unit I've had a wire come off in the plug (I assume): this however means replacing the lead as the plug is a solid, moulded on block that comes only with a new cable.

It's possible of course that a faulty socket or other part of the machine might be encountered, but I have to report that with wired remote control systems the faults I've come across have all been due to the handset.

Infra-red Remote Control

Most current infra-red remote control handsets use a single encoder/oscillator i.c. and a few external transistors to drive the LEDs. The unit used with the Ferguson 3V35/3V36 VCRs is typical – see Fig. 5. IC1 contains an oscillator and the necessary encoder for the key matrix. The encoded output at pin 17 passes to Q1 and then to Q2 which drives the transmitter LEDs D1/2 and the indicator LED D3. Other infra-red remote control units use different i.c.s, and may have a separate transistor to drive the indicator LED, but are generally similar.

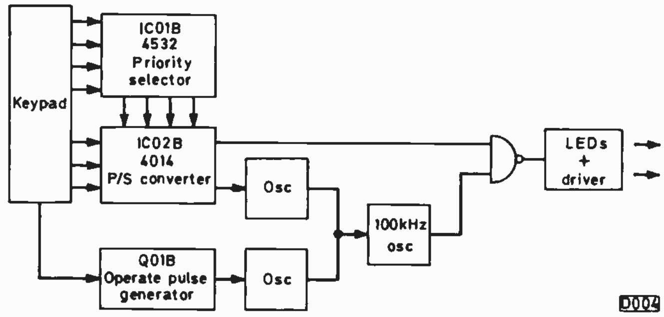


Fig. 6: Block diagram of the infra-red remote control transmitter used with the Hitachi VT8500.

The remote control transmitter used with the Hitachi VT8500 is rather different however, using six i.c.s and five transistors (see Fig. 6). When a button is pressed, an input is applied to IC01 or IC02. These i.c.s provide encoding and parallel-to-serial conversion. Button operation also brings into action several multivibrators formed from gates. These provide clock pulses, synchronisation and the

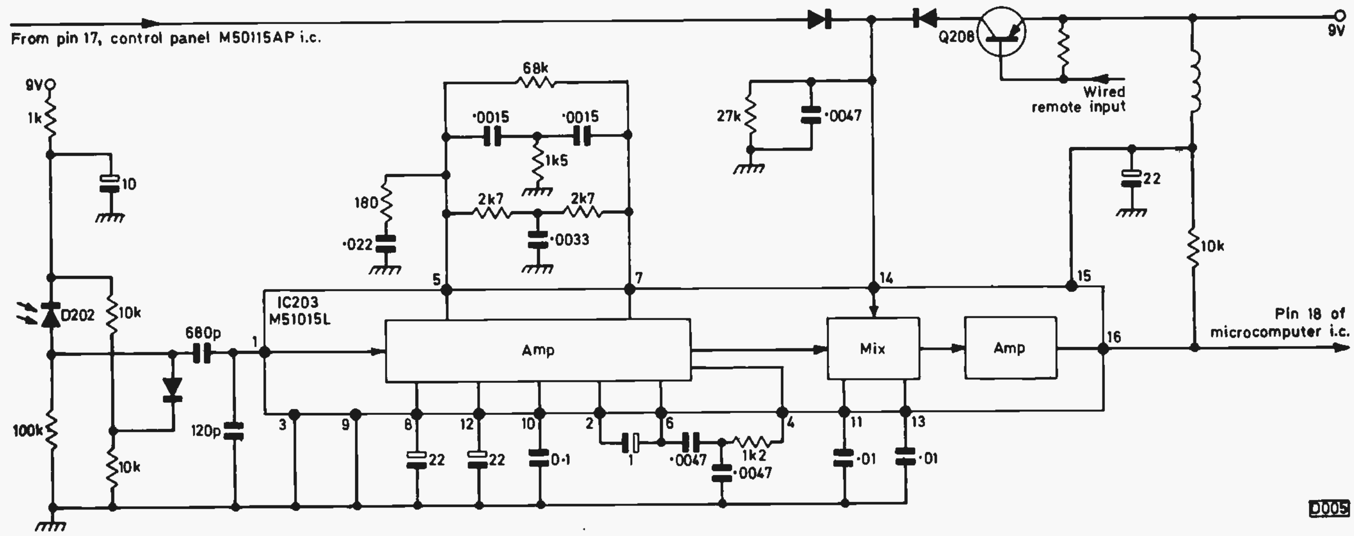


Fig. 7: Infra-red remote control receiver circuit, Ferguson Model 3V35.

carrier. A conventional transistor LED driver circuit is used.

VCRs with infra-red remote control differ rather more at the receiver end. Fig. 7 shows the circuitry used in the Ferguson 3V35/3V36. The remote input is detected by D202 and then passed to IC203 where it's amplified and mixed with the output from the VCR's own keyboard – the two sets of signals are of course the same at this point. The output from IC203 is decoded by the microcomputer i.c. The Panasonic NV7000's optional infra-red remote receiver system uses two i.c.s and a transistor in the detector/amplifier channel, the pulses from this going to another large i.c. and a number of gates which appear to the machine as a key matrix (this optional remote receiver is attached to the side of the machine, being plugged into the wired remote socket, so it's output has to appear like that from a wired unit). The Mitsubishi HS320 has an i.c. preamplifier on a small subpanel, the output from this being fed to a couple of filters and then the command decoder i.c. The decoded outputs pass to the mechanism control i.c.

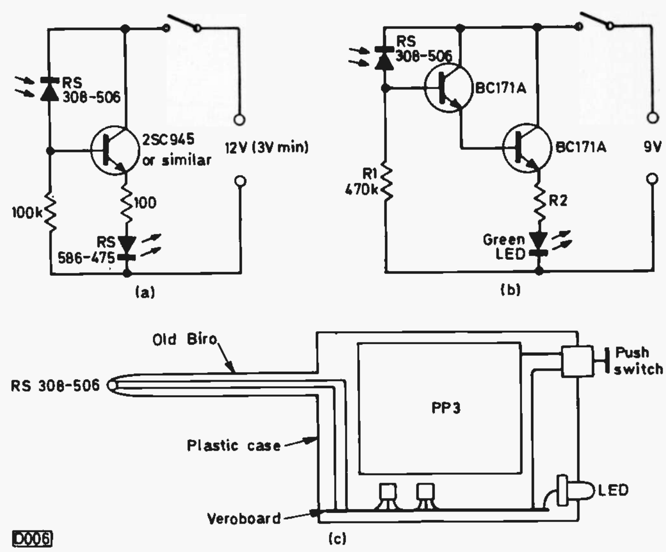


Fig. 8: Infra-red detector arrangements that can be used for test purposes. Adjust the value of R1 in (b) for the sensitivity required: add R2 if necessary to control the brightness and current.

Faults

By far the most common trouble with an infra-red remote control system is simply a flat battery. The Hitachi VT8500 can be particularly heavy on batteries, and a small modification was introduced to reduce consumption – pin 10 of IC01B should be connected to chassis. The only faults I've had have been dry-joints on the output LEDs with the Hitachi VT8500, faulty buttons on a similar unit, and a faulty button on a Mitsubishi HS320 handset (the buttons here take the form of a rubber keypad and the whole thing has to be replaced).

Infra-red Detector

If you want to be able to tell whether an infra-red remote control handset is producing an output the circuits shown in Fig. 8 should be helpful. The LED lights up when an infra-red transmission is detected (note however that this doesn't mean correct information is being transmitted). The two-transistor circuit is much more sensitive but can be affected by sunlight. Check with known good remote transmitter units to get an idea of the detection range to expect and how brightly the LED lights. The circuits are also useful for checking the infra-red LEDs used instead of cassette lamps in most current VHS machines. I built mine in a plastic box used to supply record player cartridges, with the detector mounted on the end of a Biro. No originality is claimed for these circuits – in fact the single-transistor one has appeared in an Hitachi technical bulletin.

Adding Remote Control

Finally a few words for those whose VCR has no remote control but are perhaps wondering about the possibility of adding this feature. A wired remote system is fairly easy to make: if your machine uses a ladder resistor network, duplicate this and wire the remote output across the existing control network. A matrix type remote control will require multicore cable plus a plug and socket but is otherwise simple. Check whether facilities for remote operation are already fitted, as they are in the Hitachi VT33, Ferguson 3V29 and Panasonic NV333 for example.

Infra-red remote control is rather more tricky. In some machines, such as the Ferguson 3V38, the holes for the infra-red receiver used in more expensive models are provided on the circuit board. A transmitter unit will have to be bought or built however, so the proposition is not really economic. If your machine doesn't have more upmarket relatives with remote control, then even if you build a transmitter and receiver you've got the problem of matching its output to the machine's control circuitry. Getting an output that the machine's microcomputer will understand is likely to be very difficult.

For those with mechanical keyboard type machines the only kind of remote operation that's feasible is a pause control by means of a switch wired across the microswitch used for the purpose in the machine.

The US Scene in the Fifties

Chas E. Miller

For this vintage article I'm going to cross the Atlantic to take a look at the US scene in the fifties. After several false starts, due mainly to arguments about standards, regular scheduled TV transmissions started in the USA on July 1st, 1941 – from just two transmitters, both in New York. The start was slow, with only four transmitters in operation by the spring of 1942 and sales of TV sets then standing at around 10,000. It was not long after that World War II halted further expansion. Nevertheless the later start to TV in the USA, compared to the UK, enabled advantage to be taken of a number of technical developments. To start with, 525 lines instead of 405, giving better definition. Then negative-going video modulation, which gave immunity from electrical interference and improved synchronisation – the sync pulses represent 100 per cent modulation and thus peak transmitter power. There was f.m. for the TV sound channel, and the higher field frequency of 60Hz – corresponding to the 60Hz standard for US mains supplies. The basis of US broadcasting, that the listener or viewer should have the right to a wide choice of stations, meant that multichannel tuners were in use long before they were in the UK. In their wake came vision a.g.c. to compensate for different signal strengths, and flywheel sync to stabilise the operation of the line timebase. Even so, when looking at representative US receiver circuits of the fifties one notes a more than passing resemblance to contemporary UK practice, especially of the slightly dotty kind.

Valve as Dropper

An example was the use of a valve as a high-wattage resistor (see The Case of the Curious Cossor, February 1984). But at least the Yanks got the valve to do two useful jobs. The sound output pentode was used as a dropper by tapping the h.t. supply for the i.f. stages from its cathode. With an h.t. supply of 240V at the anode of the sound output valve the cathode voltage was typically 135V. A resistive potential divider produced a supply of about 130V to bias the valve's control grid. Since the effective voltage across the valve was only some 100V, it seems odd that a 240V h.t. line was chosen in the first place. Why didn't they settle for about 120V, which would have been easy to obtain from the standard 110/120V mains supplies? A parallel situation was to be seen in contemporary Ultra UK sets which used an elaborate voltage doubler circuit to obtain an h.t. supply of 435V which was promptly dropped back to 260V with the use of resistors!

Focus Arrangements

Another way of getting the sound output valve to do two things was to include it in an electromagnetic focus circuit. Philips did this over here, by using the focus coil to provide the valve's anode and screen grid voltages. The focus control adjusted the bias applied to the valve. US practice was to connect the coil in series with the cathode of the valve, with a variable wirewound resistor in parallel. This was simpler, but again sharply reduced the effective voltage across the valve. In addition the cathode would be at a fairly high potential, increasing the risk of a heater-cathode short.

Receiver Circuits

Initially, separate sound and vision i.f. channels were used, but it was not long before the intercarrier system became general. This seemed puzzling to UK engineers at the time – we'd not then had any experience of f.m., even for radio. We couldn't figure out why the sound signal was tapped from the anode of the video output valve! Just as odd seemed the use of a triode as a sound i.f. amplifier. Crystals were only just beginning to be used as detectors. Video amplifiers were similar in most respects to those found in UK sets, with slight modifications to extend the frequency response to upwards of 4MHz. The unusual feature in this stage was the use of a variable cathode bias resistor as the contrast control.

Tubes

Both grid and cathode c.r.t. drive were in vogue, and what tubes they could be! The smallest was of 10in. diameter, the largest 30in. Bearing in mind that this was in the days of narrow deflection angles, the overall size of a 30in. tube must have been awesome (the length for round c.r.t.s was usually at least half as much again as the diameter). I saw one of these monsters at an exhibition many years ago: I've never handled one, which I don't regret in the least!

Timebases

E.H.T. supplies had by the fifties developed along the same lines as in the UK, with line flyback e.h.t. the norm. In fact the circuit of a typical US line timebase differed little from a UK one. The main difference was that parallel heater chains survived longer in the US than they did here. This was presumably due to the low mains supply voltages, which made power transformers almost essential to get a reasonable h.t. voltage: if you had a transformer for the h.t. supply, you might as well use it for l.t. supplies as well.

Triode field output valves were often used, with autotransformer coupling to the coils. The anode supply might be taken from the boost rail, which in those days ranged from about 350V to 550V. At around the same

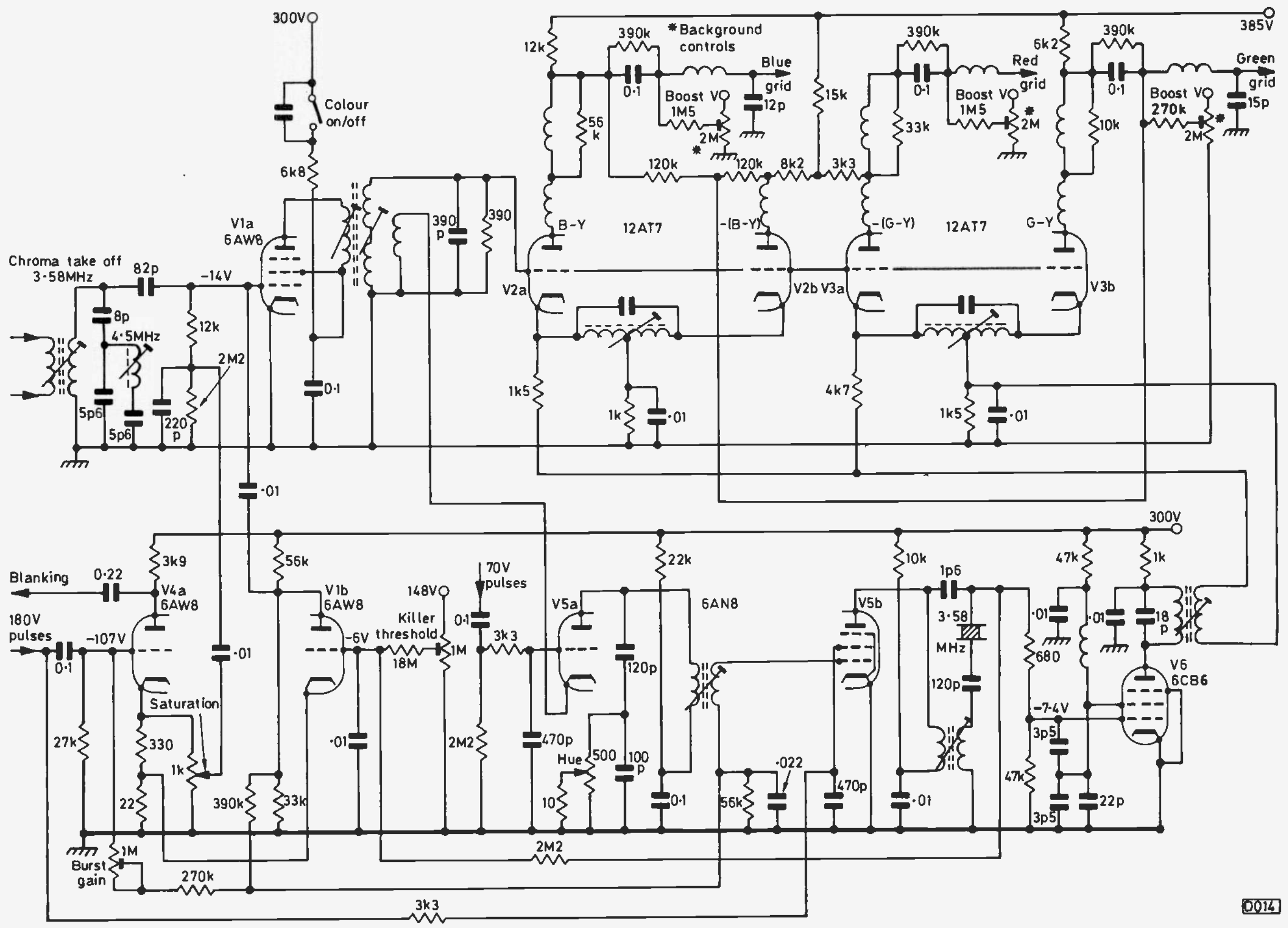


Fig. 1: The colour decoder circuit used in late-production 1957 RCA Super and Special models. The burst/reference signal section was simplified by the use of a passive subcarrier regenerator, hence no need for an a.p.c. loop. Demodulation was carried out on the B – Y and G – Y axes, with matrixing to obtain the R – Y colour-difference signal. Only a single chroma amplifier stage was used.

time the celebrated Plessey 12in. chassis, used in countless badge-engineered models in the UK, also employed a triode (6L18) field output valve: it was operated with an anode voltage of only 230V, as there was no boost line in this chassis.

Tuners

US tuner units initially had to cover only the v.h.f. channels A2-A13, so they were not unlike the turret tuners used in UK receivers in the mid-fifties. The use of u.h.f. came much earlier than in the UK however, though it was not popular to start with. This isn't surprising if the tuner circuit I have to hand is at all typical. It employed a crystal mixer with a simple triode oscillator and no r.f. amplification, so what the gain was like is anyone's guess. In the event, the situation that developed was not unlike that in the UK when BBC-2 first went on air a dozen years later. After an initial boom, viewers decided that the u.h.f. stations didn't offer a sufficiently attractive alternative to the existing v.h.f. services to make it worth their while to install converters and aerials. Only in areas where there were no v.h.f. stations did u.h.f. really take off. By the mid-fifties nearly a hundred u.h.f. stations had closed down, and a much larger number that had been authorised never went on air at all. About a hundred were active, mainly in areas that lacked v.h.f. competition or operated by non-commercial organisations.

The twelve v.h.f. channels could support over 600 separate stations in the USA, but the FCC wanted to allocate even more. The only way to do this was to use u.h.f., which with 70 channels could provide another 1,500 outlets. Thus arose a typical chicken-and-egg situation. Would-be station operators would not use u.h.f. because there were so few receivers capable of u.h.f. reception (an "insignificant proportion of the nation's 56 million sets" according to one report), while the public would not buy u.h.f. sets because there were so few stations for them to tune to. One proposed solution was to reallocate the existing v.h.f. stations so that some of them would have to use u.h.f.: not surprisingly their owners protested vigorously and the idea was shelved. Eventually Congress took a hand, and in mid-1962 President Kennedy signed a bill requiring that henceforth all TV receivers produced must incorporate a u.h.f. tuner.

Colour

The big event in the fifties however was the start of colour TV – regular transmissions, using the NTSC system, commenced in December 1953. The foregoing comments on contemporary US monochrome receivers might suggest that colour sets when they came would be extremely complicated beasties, especially as virtually no semiconductor devices were used. Not a bit of it! My first impression when I looked at the circuit diagram of the RCA Super series was that it had been considerably simplified to clarify the operation. This was not the case however. Everything was there, and the valves and components really were as sparse as they appeared to be at a first glance. What we'd call the decoder used just ten valve sections and a handful of capacitors, resistors and coils – see Fig. 1. This circuit, dating from 1957, may possibly have looked complex at the time. Today it looks ridiculously unsophisticated. Let's take a closer look.

The chroma take-off transformer, in the anode circuit of a video amplifier at the end of the i.f. strip, was tuned to 3·58MHz. A 4·5MHz sound trap was incorporated at this point. The chroma signal thus developed was applied to the control grid of V1a, a tuned amplifier with a bandwidth of 500kHz. This drove the grids of the four triodes V2/3 used for synchronous demodulation. We'll return to these in a moment.

A coil in V1a's anode tuned circuit fed the cathode of the burst gate/amplifier triode V5a, which was gated on by 70V line-frequency pulses applied to its grid. The burst signal developed in its anode circuit was applied to V5b for further amplification. This pentode was also gated, at its screen grid. A phase shift network in the coupling between these two valves provided hue control, with a range of ±45°. The subcarrier regenerator was of the passive type, i.e. the output from V5b drove the tuned circuit that included the 3·58MHz crystal. V6 amplified the reference signal and drove the cathodes of the synchronous detector triodes via transformers that provided the required phase conditions.

A rather odd aspect of the circuit was the use of pulses to provide gain control in both the chroma and burst channels and colour killing. 180V line flyback pulses were applied to the grid of V4a, which developed a negative voltage of −107V at this point by grid current action. The negative bias thus produced was applied to the control grid of V5b via the burst gain preset to control the gain of the burst amplifier. The positive-going pulses developed at the cathode of V4a were similarly used for saturation control and colour killing. The 1kΩ colour control fed the pulses to the control grid of the chroma amplifier V1a, developing a bias voltage of −14V at this point. Obviously the greater the amplitude of the pulses the greater the bias voltage developed. A second pulse feed was applied to the cathode of the colour-killer triode V1b. On a monochrome transmission the amplified pulses appearing at its anode produced a sufficiently negative bias at the control grid of V1a to cut it off. The reference oscillator circuit, being of the driven type, was active only when the bursts were present. The negative bias then produced at the control grid of V6 was applied to the grid of V1b, cutting this triode off so that V1a was left under the control of the saturation potentiometer. All rather crude but no doubt effective.

Back to the synchronous detector triodes. These conducted on the negative-going tips of the 3·58MHz waveforms applied to their cathodes, producing the B–Y signal at the anode of V2a, the G–Y signal at the anode of V3b, and the R–Y signal after mixing in the anode circuits of V2b/V3a. The high-level outputs produced by these triode synchronous detectors drove the tube's grids without need for further amplification. Colour-difference drive was used of course, with the luminance signal applied to the tube's cathodes.

So there we have it. Colour as well for only five and a half bottles. NTSC has been referred to as "never twice the same colour", though you have the hue control to get it right. One wonders how things are today in the US: maybe someone over there would care to comment?

Long-distance Television

Roger Bunney

August was an extremely productive month, with excellent Sporadic E openings during the earlier part and a really dramatic period of tropospheric reception towards the end. Lots of news, so without further ado here's the August UK SpE log:

7/8/84	TVE (Spain) chs. E2, 3, 4; RAI (Italy) IA; ORF (Austria) E2a; TSS (USSR) R1; CST (Czechoslovakia) R2.
8/8/84	RAI IA; JRT (Yugoslavia) E3, 4; ORF E2a; +PTT (Switzerland) E2; MTV (Hungary) R1; TVP (Poland) R1; TSS R1; TVE E2.
9/8/84	TVP R1; CST R2; TSS R1, 2; SR (Sweden) E2; RUV (Iceland) E4; NRK (Norway) E2, 3; TVE E2; RAI IA.
10/8/84	TVE E2, 3, 4; JRT E3; RAI IA; DFF (East Germany) E4; TVP R1, 2; TSS R1, 2; CST R2; SR E2.
11/8/84	TSS R1, 2; TVP R1, 2; CST R1; SR E2, 3, 4; NRK E2, 3, 4; MTV (Hungary) R1; ORF E2a; +PTT E2; RAI IA; TVE E2, 3, 4; TVE-2 E2; RTP (Portugal) E3; ARD (West Germany) E3.
12/8/84	TVE E2, 3; TVE-2 E2; RAI IA, B; DFF E4; SR E2; NRK E2; TSS R1.
13/8/84	RAI IA; CST R1; NRK E2.
14/8/84	CST R1; DR (Denmark) E3; RAI IA.
15/8/84	TVP R1; CST R1; TSS R1; NRK E2.
16/8/84	CST R1, 2; TVE E2.
17/8/84	TVP R1; TVE E2.
18/8/84	TSS R1; CST R1; NRK E2; +PTT E2.
19/8/84	RAI IA, B; TVE E2, 3, 4; TVP R1.
20/8/84	TVE E2, 3; RAI IA; JRT E3, 4; MTV R1; ARD E2; TSS R1, 2.
21/8/84	ORF E2a; TVP R1; TVE E2, 3, 4.
22/8/84	TVP R1.
23/8/84	CST R1.
24/8/84	RAI IA; TVE E2, 3, 4; MTV R1, 2.
27/8/84	TVE E2, 3, 4; RAI IA, B.
28/8/84	RAI IA.
30/8/84	TSS R1, 2.
31/8/84	RAI IA; TSS R1.
1/9/84	SR E2.

Pressure remained high during most of August, resulting in two periods of good tropospheric conditions. The first was from the 10th to the 17th, when many enthusiasts received Holland, Belgium, Denmark and numerous Norwegian Band III stations almost daily. In the best locations reception at over 500 miles was possible using relatively simple equipment. From the letters I've received it's clear that many relatively new enthusiasts achieved their first "real" tropospheric results. Of particular interest, Cyril Willis (Ely) received system M (525 lines, 60 fields) signals from the AFRTS/AFN base at Shape, Holland, on ch. E34. He found that his valved KB Featherlight receiver locked well without any adjustment. I owned the set myself at one time and remember some years back receiving ch. A2 (system M) signals on many occasions when the conditions in the F2 layer were good.

After a brief lull a further period of enhanced tropospheric activity started on the 20th, with signals from much of central Europe though with a tendency for reception on a north/south path to predominate. Conditions peaked on the 25th/26th with Band III and the u.h.f. channels literally jammed. Examples of reception on the 25th include Switzerland and the French Canal Plus programme (in colour on ch. F5) in Scotland, plus teletext DX from W. Germany at the same location. Iain Menzies (Aberdeen) comments that ZDF, NDR, WDR, DR, RTB/BRT, NOS and NRK signals filled the band. A bonus was RTL Plus (Luxembourg) on ch. E7. Norwegian Band III signals reached as far as the southern UK while, unusually, NOS/RTB/BRT were well received on ch. E4 over much of the UK as far as the W. Midlands and north Scotland. Unfortunately I missed this opening as I'd just gone on holiday. Typical, but a good time was had by most, with the main W. European Band III and u.h.f. transmitters received with varying degrees of clarity. On the amateur radio front, I gather that the Faroe Islands were received in the UK and the Shetlands in the London area during this opening.

An interesting sea path opened on July 4th when Dave Last (Truro) had two-way contact at both 144 and 435MHz with EA8XS in Las Palmas, Canary Islands. On the following day EA8XS was received in S. Wales!

Dave Shirley (Hastings) reports that there's an Antenne 2 (TDF) programme called "Le Club du Television du Monde" every Thursday night at 2035 French time. It includes programme examples from overseas TV services with station logos, opening/closing routines etc.

My thanks to the following for sending in reports: Cyril Willis (Ely), Dave Shirley (Hastings), Iain Menzies (Aberdeen), Simon Hamer (Powys), Keith Chaplin (Barrow-on-Soar), Paul Barton (Harrogate), Bill Cotterill (Tipton) and Alan Beech (Dollar, Scotland).

For the record, Dave Shirley received RAI-1 ch. IF Udine, N. Italy via tropospheric propagation on May 5th last at 1300 BST, the programme material consisting of a football match and interviews with Roma FC players. G3COJ had two-way contact with W6JKV/OX (Greenland) at 50MHz on June 24th (2308 GMT). On June 30th/July 1st GJ3YHU at St. Lawrence, Jersey, Channel Islands had two-way contact with 46 stations along the US/Canadian eastern seaboard between 2234-0057 GMT, again at 50MHz.

News Items

UK: Racal are applying for planning permission for lattice masts, typically 30m high, throughout the UK to carry PMR and communications aerials for the cellular radio service. The siting seems quite close: in south Hampshire for example a mast two miles north of Southampton has been approved and permission is being sought for another 19 miles away at West Cowes, Isle of Wight. Many of the services will operate in Band III.

The British Amateur Television Club has produced a booklet entitled "Introducing Amateur Television" for all new members. Membership details can be obtained from BATC, Grenehurst, Pinewood Road, High Wycombe, Bucks HP12 4DD – include s.a.e. with enquiries.

France: Canal Plus scrambling will include suppression of the a.m. sound carrier. A decision on DBS standards is being kept open though narrow-band MAC transmissions have been carried within the normal system L bandwidth by the Rennes "Reseau 4" v.h.f. transmitter. Breakfast TV may start this autumn.

Belgium: The French TV5 satellite downlink channel now

has scrambled vision: a 1-2μsec delay on a random basis is introduced at the beginning of each line, giving the appearance of several overlapping pictures. A digital signal is incorporated in the field blanking interval to synchronise the descrambler's random generator. Canal Plus has been seen using a similar type of scrambling. The Brussels TV5 output on ch. E56 is unscrambled but cable operators have to do their own unscrambling. A Pay-TV service for French speaking Belgium is being planned by RTBF and the Dupuis publishing company: descramblers would cost 2,500Bf and the programme content would consist mainly of feature films on a rotating schedule.
Luxembourg: The Coronet consortium is to commence its DBS service in the summer of 1986 using a medium power satellite (−50dBW) at 19°W.
Satellites: The common SRG/ORF/ZDF programme via ECS is to start on December 1st, with five and a half hours' programming daily. The Japanese firm Uniden, noted for its CB rigs, has entered the 4GHz satellite field with a complete TVRO package which is marketed under the Unisat label. Prices are expected to drop to the extent that later next year an upmarket TVRO package should cost much the same as a full-feature VCR. Uniden also intends to produce 12GHz equipment. The Electra Company which manufactures Bearcat scanners has also entered the 4GHz TVRO market.
Spain: New EBU listings – TVE-1 Madrid ch. E49, TVE-2 Madrid ch. E55, 117kW e.r.p. horizontal in both cases.

IF Selectivity Unit

The U800 i.f. selectivity module from the Philips G8 chassis has been widely used by DXers to obtain reduced i.f. bandwidth – essential where channels are close (e.g. E2/R1 vision) in order to minimise signal overlap and floating images. The idea is to incorporate the unit between the tuner and the main i.f. strip, with the module modified for narrow/normal operation. Unfortunately the module is no longer available: to overcome this problem Paul Barton has designed an alternative (see Fig. 1).

The coils can be tuned to provide a very narrow i.f. passband of some 1MHz. This will result in degraded picture quality of course, so a compromise is required between quality and minimum adjacent channel interference. The bandwidth can be widened to some 3-4MHz by adding 1·5kΩ damping resistors across L1 and L2. Alignment is relatively easy and is best done on an actual signal. L1 and L2 have a sharp peaking, notch-like effect whereas L3 has a relatively flat response. Tune to a steady fringe

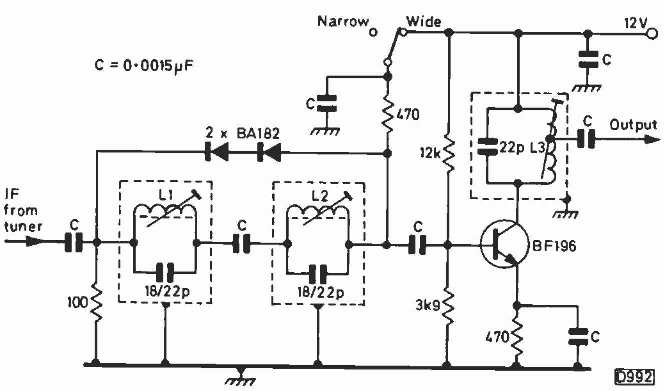


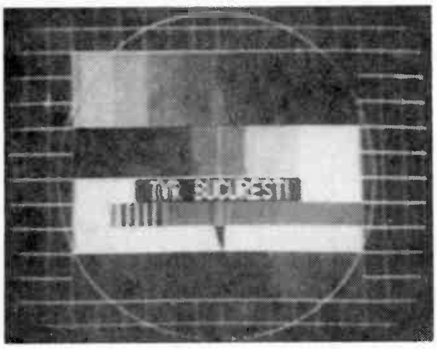
Fig. 1: Circuit of Paul Barton's i.f. selectivity module. L1 and L2 consist of 15 turns, close spaced, of 28 s.w.g. wire on a 3/16in. (4·5mm) former with core. L3 is the same but centre tapped.

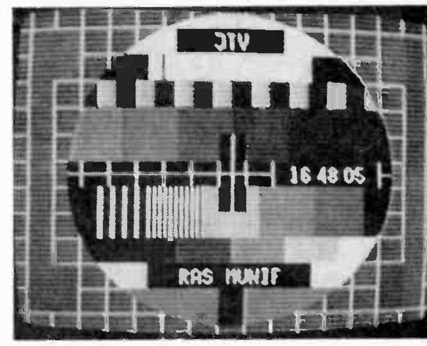
signal or a local signal attenuated to give a weak, noisy (but non-fading) signal. Peak L3 first. Though its response is flat, picture improvement should be seen. Note the definition. Peak L1 at the l.f. end (core in) and L2 at the h.f. end (core out). Balance L3 and observe the picture, preferably on a test pattern so that the bandwidth reduction can be assessed. If a smeary picture lacking detail is seen, the bandwidth is likely to have been considerably narrowed. Stagger tuning L1 and L2 will then increase the bandwidth to the extent you consider necessary. Personally I feel that a bandwidth of 2MHz provides a reasonable compromise.

Paul found that the ET021 tuner likes to see a 100Ω resistor across its output. 3-30pF trimmers could be used in place of the 18/22pF tuning capacitors to give a wider range of alignment where alternative coil formers are used. The unit exceeds the performance of two peaked G8 units in series: it can easily separate ch. R1 vision from a strong local ch. B2 signal. Let us know how you get along with it.

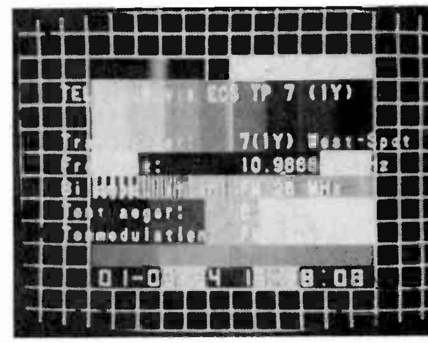
Satellite TV Services

An increasing number of TV programmes are available to the satellite TV enthusiast, particularly in the 12GHz band. There are the well-known three Gorizont channels at 4GHz, and in the not too distant future Arabsat signals will be available with channels in the 2·6 and 4GHz bands. It may be helpful to list present and future channels intended for downlinking to cable operators at 11-12GHz. The London based Sky Channel has been on air since April 1982. It uses Oak/Orion scrambling and is downlinked by transponder six on ECS-1. Other ECS-1



Left: TVR (Rumania) FUBK test pattern, Bucharest ch. R2, received by Ryn Muntjewerff in Holland. Centre: Syrian news announcer received by Petri Pöppönen in Finland. Right: Ras Munif-Ajlun, Jordan ch. E9 500kW, received in Cyprus by Marios Colocassides, with Syrian co-channel.



Left: 4GHz (C band) satellite reception by Frank Lumen in Denver, Colorado. Centre: Another example of Frank Lumen's C band reception of signals from Los Angeles. Right: Satellite reception in Europe – ECS-1 transponder 7 downlink signal, Teleclub programme source.

transponders in use are as follows: 12 – Thorn-EMI "Music Box" pop video programme; 4 – French-language TV5; 10 – PKS, a German entertainment programme from Frankfurt; 7 – PaySat, a Swiss feature film channel. The TV5 service is scrambled at times using a system called Discret-1 (see News Items, Belgium). Planned ECS services are: Euro-TV, a Dutch based movie/entertainment channel due to start this autumn; a German-language programme compiled by ZDF from the various German TV networks, using transponder 2 and probably with system SIS/PCM2 scrambling; and Esselte, a Swedish channel expected to be on air early next year, using transponder 9. There's also a vague plan for a European service to be called Eurikon, originating from Hilversum.

Other UK based services in operation are: TEN with nine hours of movies and other entertainment daily from Intelsat 4W; the Premier movie channel from Intelsat 6W; and Screen Sport, six hours daily, from Intelsat 3W.

Planned for next summer are a Childrens channel, a telesoftware channel, and a 24-hour World News Network channel run by Visnews. W.H. Smith plan to start a Games Network with computer games and business data, and Wyvern TV (Swindon) plan to start a channel offering general programmes and documentaries.

From our Correspondents . . .

Frank Lumen of Denver, USA (formerly Glasgow) has been successful with reception from several satellites, using a 1·8m dish and 4GHz (C band) receiver. He reports that the Olympic Games kept the communications craft busy – Frank logged signals going to all parts of the globe, many from Intelsat 4 at 53°W.

Wenlock Burton (Victoria, Australia) comments on the problem of interference produced by computers. Apparently the TRS80 and Apple 2 microcomputers have to be fitted with an r.f. shield for sale in the USA in order to comply with stiff FCC regulations. The shields are omitted from export versions, apparently due to relaxed or non-existent radiation regulations. The Australian Department of Communications plans to clear TV channels 3, 4, 5 and 5a and establish extra channels between the existing 9, 10 and 12. A stereo TV sound system using a second carrier spaced at 242kHz above the main sound carrier, with 50kHz deviation, has been approved.

Keith Chaplin of Barrow-on-Soar, Leics had considerable success during the recent SpE and tropospheric openings. He's well equipped, with a Vega 402D, a dual-sound/teletext Luxor receiver, wideband aerials for Bands I/III and u.h.f., amplifiers, a rotor and more importantly a clear take-off at 500ft a.s.l. from south to north!

Nick Harrold (Essex) recently visited the Canary Islands to assist with the installation of a large satellite dish for TV reception high up on a mountain. The installation belongs to some exiled Canadians who wanted to watch AFRTS from Intelsat at 1°W. In addition to this it was found that virtually noise-free pictures could be obtained from Satcom 2R at 72°W.

Tropical Aurora

An article on this subject appeared in a N. American radio magazine recently. It seems that in equatorial regions the extreme outer fringe of the ionosphere thickens and is rendered reflective by constant, direct solar bombardment. The phenomenon occurs at ±15° of the Equator and is similar to a polar aurora. Strong v.h.f. signals are reflected, giving incident signals with a characteristic fluttery quality, present at times when F2 layer activity is low. One result is that many Argentinian paging stations operating in the 40MHz spectrum are well received in N. America.

TV Fault Finding

Reports from Peter H. Dolman, T.Eng., M.S. Barakat, Jim Rainey, Malcolm Burrell, Philip Blundell, Eng.Tech. and Mick Dutton

Panasonic TC2203 (U1) and TC2205 (U2)

A common fault with these sets is normal sound, blank screen. There are three likely causes. (1) The 7·5V zener diode D351 which links the emitters of the RGB output transistors to chassis. (2) The 6V zener diodes D818 and D819 (D857/8 is the U2 chassis) which provide the reference voltage in the 12V regulator circuit. What usually happens is that the zener characteristics change, as a result of which the regulator's output rises to 13V or more, producing saturation in the TDA2530 i.c. (IC301). Note that if the regulator's output falls below 10V the result is loss of colour. (3) If R621 (82kΩ) is open-circuit the TDA2530 will receive no clamp pulses at pin 8. The result is blanking (no modulation).

The TDA1104SP field timebase i.c. in the U2 chassis can cause loss of raster – it contains a safety circuit. To check, probe pin 8 with the meter switched to its lowest d.c. range to shunt the safety blanking pulses. You may then find loss of field scan or partial field collapse.

A small picture with a hum bar and sound that varies in sympathy with the contrast and brightness in the U2 chassis means that the 160V line reservoir/smoothing electolytics C852 (100µF, 250V) and C857 (47µF, 250V) are defective. I usually replace them with 350V or 400V types.

Sound fading with the U2 chassis can be due to any of the following items on the remote control decoder panel: transistors Q1003/4 (both type BC237B), D1008 (OA91), D1006 (5V zener diode) and R1015 (12kΩ). **M.S.B.**

Rank Z718 Chassis

This set suffered from poor EW correction and bent verticals. The width and raster correction controls worked but seemed to adjust rather critically, while the verticals straightened out only at low contrast control settings. The e.h.t. regulation also seemed to be worse than usual, with a fair degree of blooming.

The EW correction circuit is called upon to do quite a lot in this chassis – regulation and breathing compensation as well as raster correction. Checks revealed that the waveforms at the base and collector of 4VT16 were similar instead of being inverted at the collector. So although it was possible to get a poor but tolerable raster shape by adjusting the controls the sense of the width and breathing correction was incorrect. Replacing 4VT16 and setting up the circuit restored normal operation. **P.H.D.**

Sharp C2092

This set entered the service department suffering from amnesia: its digital tuning system was able to search for and lock to the required channel but the tuning point couldn't be stored – thus all was lost on channel change. A breathtaking 13 i.c.s and 20 transistors are used in the tuning, control and memory circuit, supplied from five l.t. rails... Investigation revealed that the 10V rail was low at around 6.5V, due to lack of drive to Q1019 from I1010 (see Fig. 1). The cause of this was traced to R1072 (33kΩ) being open-circuit – the voltage at pin 2 of the i.c. had fallen to less than 1V instead of being clamped to 15V by D1017. A 1W type is suggested rather than 0·5W as originally fitted. **P.H.D.**

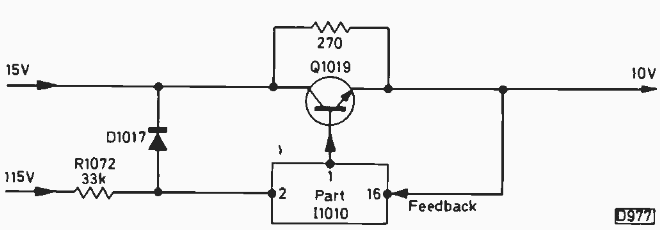


Fig. 1: 10V regulator used in the Sharp Model C2092's digital tuning system.

Amstrad 22in. CTV

Poor field lock has been a problem with a few of these sets, but the recommended method of setting up the hold control is not exactly obvious. First set the field hold control RV801 to mid-position, then connect a meter (preferably a digital one) to measure the voltage at the junction of RV805/R816 with respect to chassis. Adjust RV801 for a reading of 15·1V. This cures the fault. **J.R.**

Finlux 9510

A new set came into the workshop to have a teletext decoder fitted. When it was tested however it wouldn't work correctly in the mix mode – instead of the picture appearing behind the text there was a grey background. Substitution proved that the decoder was at fault, so scope comparisons were made between the two boards. The only signal that differed on the faulty board was the blue drive signal to the TV set. This was 1V too large and didn't respond to adjustment of the blue text amplitude control Pt4 which turned out to be open-circuit. The TDA3560 colour decoder i.c. in the set must have been objecting to the excessive signal input. **P.B.**

ITT80 – 90° Chassis

The problem with this set (Model CC1814) was intermittent colour on channel 8 only. This would normally be due to a faulty 1N4148 diode in the tuning potentiometer circuit, but in this case the picture was hooking at the top as well. The cause was C721 (100µF) being low in value – this electrolytic decouples the supply to the TDA9503 line generator i.c. **P.B.**

ITT CVC1204 Chassis (CVC1200 Series)

The latest ITT service bulletin has a fault-finding procedure for these sets, so when one came in I pounced on it, thinking that the repair would be easy. It wasn't. The set was dead, so I removed the scan coil plug and loaded the h.t. reservoir capacitor C733 with a 60W bulb. The h.t. read 20V then, after a couple of seconds, the switch-mode power supply shut down with a cheep. This proved that the power supply was at fault, and as the guide suggested I went on to replace the various diodes and transistors, getting nowhere in the process. In desperation I resorted to plan A and got the scope out. This showed that the supply was oscillating faster and faster until it gave a cheep and shut down. All likely looking capacitors were changed to no avail so I rang Mr. ITT. He said that the switch-mode power supply transformer itself set the frequency of oscillation, though he didn't sound too sure about what was wrong. Anyway a new transformer restored normal operation – three cheers for Mr. ITT! **P.B.**

Philips 1250

This set is fitted with the K30 chassis and has teletext and full remote control. The customer's complaint was no picture except via their VCR. On investigation we found that there was no tuning on channels 1-4 though the VCR worked correctly via channel 12. We were able to tune in TV stations on the other channel positions so the problem was to do with the first four positions. The fact that the correct LED display was being shown suggested that the key pad, encoder and TMS1000 microcomputer i.c. were working correctly and providing the appropriate digitally coded outputs for the tuning drawer. This incorporates three decoder i.c.s, one for every four channels. The problem was due to the failure of the SN29770BN responsible for selecting channels 1-4. **M.D.**

Grundig CUC40 Chassis

Field collapse was the problem here. We soon found this one. D2758 (SKE2F1/01) on the deflection subpanel was open-circuit, leaving the output section of the TDA2655B field timebase chip with no power supply. **M.D.**

ITT CVC1200 Chassis

We've had several of these sets in the workshop recently. On the whole they seem to be reliable. Two have had faulty BU208D line output transistors and several have had tuner/i.f. module faults such as tuning drift and snowy pictures. The TDA3561 decoder i.c. occasionally gives lack of one colour, usually intermittently. On remote-control sets the push-button mains switch is soldered to the printed panel and we've had one burn up caused by a bad joint, just like earlier ITT sets.

One colour weak with flyback lines in this colour has been caused by the BF393 transistor in the relevant output stage going short-circuit. When this happens the collector resistor usually burns up.

One fault that lead us a merry dance was due to transformer Tr712 which couples the drive to the switch-mode power supply board. It went open-circuit intermittently, the result being a small raster with the h.t. supply falling from 117V to about 80V. The fault would come and go when the chassis was flexed.

One new set was found to have a cracked tube. This produced a pretty display of fireworks but also did quite a lot of damage. The tuner/i.f. module wouldn't tune in, two of the video output stages had blown up, there was no colour due to the failure of the TDA3561, and there was only a blank raster in the picture mode with the teletext display normal. After a lot of searching we found that R503 (39kΩ) in the beam limiter circuit was open-circuit. Replacing this didn't provide a cure but when the associated decoupling capacitor C503 (0·056μF) was bridged a normal picture returned. When C503 was removed it was found to have no inside – and there was a burn mark on the board where it had been.

A common fault is a blank raster due to no h.t. supply to the RGB output stages. This is caused by rectifier diode D505 (BA159) going short-circuit as a result of which the 1·5Ω surge limiting safety resistor R514 goes open-circuit. **M.D.**

Grundig 5010 Series

I've never been very fond of these sets, though I'm now beginning to get to grips with them. One we had would work for half an hour and then go dead, leaving channel selector number 4 illuminated. After some time the set would start working again and automatically switch to the channel 1 position. A search for dry-joints didn't reveal anything so some voltage checks were made. This led us to the transistors in the 15V regulator circuit (Tr635/6). Changing them cured the problem.

Another of thse sets would occasionally blow its cutout. The usual checks for dry-joints around the commutating transformer etc. didn't help. Eventually with the chassis hinged down I noticed an arc in the area of one of the thyristor holder fixing screws. One of the ceramic capacitors was earthed to this and cleaning its tag and tightening the screw solved the problem. **M.B.**

GEC 1402

These GEC 14in. portables are fitted with the ITT CVC801 chassis. One came in recently with no sound when switched on: after a couple of minutes there was distorted sound. The TDA1035T sound channel i.c. is in the r.f./i.f. module. On taking this to pieces and checking around in the sound section I found that C228 (100μF) was leaky.

The problem with another of these sets was intermittent low-frequency whistle from the line timebase area. Careful probing led us to the linearity coil L505, but soaking in resin and repositioning it failed to cure the fault. It took only half an hour to remove, unwind, then rewind the coil. This produced a complete cure. **M.B.**

Thorn 1696 Chassis

The complaint was that the field scan became cramped, mainly at the top, when the set had warmed up. Well, there's not a lot in the circuit! Replacing the TDA1044 field timebase chip made no difference; the resistors were all within tolerance; and none of the capacitors gave any indication of being leaky. There was a production modification to cure cramping – R67 was changed from 33kΩ to 27kΩ. So I checked this and found that it was 27kΩ. Perhaps if I changed it back? This did the trick! There was still some slight non-linearity at the bottom of the picture so I changed R65 (15kΩ) and obtained much better results – perhaps this was a tolerance problem (the set was almost new). **M.B.**

Philips KT3 Chassis

I've had a number of interesting faults with these sets recently. In one case (Phase II version) there was no green and a scope check showed that the TDA3560 decoder i.c. wasn't producing a green output signal. The green clamp reservoir capacitor C45 (0.022μF) was leaky.

Another problem was tripping when first switched on. I eventually removed the field scan coil plug and the tripping stopped. Changing the yoke cured the problem though resistance measurements failed to reveal the cause of the trouble.

I always hate remote control faults! The set concernced was fitted with the Telco remote control decoder panel and the fault was no remote or front panel control. I grabbed the only chip available and plugged it in – the SAF1032P. Fortunately this restored everything to normal.

As most of you in the field will know, a dead KT3 usually means that the 4·7Ω surge limiter resistor R291 is open-circuit. Before leaving the rectifier panel and starting on the switch-mode department a quick check on the 12V zener diode D300 could save you time. In a recent dead set case I found that it was short-circuit. **M.B.**

Pye/Philips Remotes

Harold Peters

I simply couldn't believe it. Knowing the Pye G11 like the back of my hand I dived into a Philips G11 offering the same facilities and found myself in a strange new world. The front end was totally different. This led me to check up on what goes with each set, and I was dismayed to find eighteen different, incompatible combinations in use with the G11 chassis alone. Philips have used about a dozen basic systems with forty incompatible subdivisions. Let's start at the beginning.

Dynatrons

The earliest remote control systems you're likely to encounter are the wired ones used in certain Dynatron models. A screened, multicore cable links the hand unit to the set: if it should pass close to high electric fields or an unbalanced mains supply hum will be induced on the varicap tuning line. There are two versions, the later one with a mains standby switch, and they don't interchange. A loose shorting plug hangs inside the set, permitting the assembly to be removed for service without leaving the set inoperative (second version only).

Some hybrid Dynatron models were fitted with an ultrasonic (US from now on) full remote system, and again there were two versions. The earlier had buff handsets, a totally screened receiver unit and analogue controls with only eight abrupt steps. The later version had black handsets, an open receiver board and twenty-step analogue controls. Pressing a button sent out one US tone for a certain time, after which it changed to a second frequency. Cats and dogs usually left the room.

Philips G8 and G9 Chassis

A simple "pinger" unit was employed with the G8 and G9 chassis. The handset has a mechanical tuning fork which is plucked each time the button is pressed. Gives sequential channel changing via an i.c. inside the touchbutton panel on the set. Effective, but so is a bunch of keys.

There was a restricted issue of G9 sets with teletext, using the Tifax module. The handset did teletext only, with no analogue controls or channel change. Tifax modules can be identified by having to press a page button before the page number.

The G11

A most bewildering series of remote control arrangements was used with the G11 chassis: simple remote, full remote, three phases of teletext and a viewdata version all in US form, then full remote, teletext and viewdata in infra-red form (IR from now on). Pye and Philips sets have different front ends, resulting in eighteen incompatible combinations. We'll look at the US range first, ignoring the few viewdata sets that had a modem beneath in the legstand plinth. US systems can select six channels, IR eight.

Philips sets with US remote control have a common tuner drawer for the simple remote, full remote and teletext versions. Pye sets have a common front control panel for simple and full remote, and the same board for teletext but with differences in the volume control: a separate PCB contains the touch-tune i.c. (it's in the tuner drawer in Philips models). Simple remotes use a two-tone system – 39kHz mutes the sound, 37kHz changes channel. Handsets mostly need tuning up and the touch-button i.c.s can stick on one channel. Full remotes use fifteen precise frequencies from 33kHz to 44kHz, divided down from a 4·43MHz crystal. Most of these tones produce an audible note when a working handset is held close to the ear.

Handset faults are common and expensive to cure. A coarse, audible tone suggests a faulty transducer. Any fluid will kill off the keypads immediately. Totally dead handsets could have a loose i.c. For poor range, try the transducer, the position of the receiving transducer in its tube, and C9 (4·4μF) and C13 (22μF) in the receiver i.c. can.

Teletext systems with US remote control came in three phases. Phase 1 (white label) has development type i.c.s (numbers begin M . . .), no double-height facility and three buttons are missing from the handset. Incompatible with later types. Phase 1¼ (yellow label) has SAA type i.c.s, double-height facility and a small regulator board that plugs into the side of the decoder panel. Compatible with phase 1½ (green label) after removing the regulator board.

There were full remote and teletext versions of the G11 IR system, with common front ends though different for Philips and Pye. Hence four combinations. The teletext system is phase 2 (blue label). This is as phase 1½ but with an SAA5040A i.c. in place of the SAA5040 for eight channels. There were Pye and Philips viewdata versions with a three-tier modem inside the set and an extra button on the handset. For the workshop a teletext handset can be converted for viewdata use by making a small hole in the keypad where the extra button comes and pressing the bubble beneath with a ball pen.

Note that with phase 1, 1¼ and 1½ teletext decoders the power supply comes from a large chopper board on the floor of the cabinet. Power for the phase 2 decoder comes from the line output transformer which has extra windings

– the line scan panel is distinguished by the blue fibreglass board with two extra pins coded blue and yellow.

K Series Chassis

The G11 was the last Croydon design. The subsequent K (Kleuren) chassis are of European design adapted to standard I (with suffix /05 or /15 after the model number). There are several remote control systems, all IR, including Long, Telco, VST and TRDIV.

Long comes in two versions. The 868 used with the projection set and video centre selects 29 channels, with coloured horizontal bars superimposed across the picture to assist the tuning. The F8 is at present confined to Model 3761.

Telco (KT3, K30 and K12 chassis) is a twelve-channel system using the same RC4 command codes as Long 868. The other facilities are standby mute, three analogue controls and a granny button. Identified by absence of knobs (all pushbutton) and coming out of mute when channels are changed.

The handsets for these systems have an aversion to fluids. Failure of the SAF1032 i.c. on the Telco decoder panel is not uncommon.

RC5 Handset Code

VST, TRDIV, a system we'll call RC5 Teletext and some simple remote systems use a handset code called RC5 – the handset numbers all start RC5. In a showroom, any RC5 handset will affect all RC5 sets, but not necessarily in the same way!

The Mullard teletext decoder boards respond to handset codes such as those generated by the G11 and Thorn chassis. RC5 was primarily developed for Continentals who like to have forty channels at their fingertips. For use with Mullard teletext boards an interpreter is required to translate RC5 into English. This takes the form of a TMS1000 microcomputer i.c. on a panel between the controls and the teletext decoder. The TMS1000s come in two mask versions which are incompatible. Philips Service issue only mask MP0096, with fitting instructions for earlier boards. So on KT3/K30 sets the signal from the handset goes from the eyeball IR receiver to the control panel then to the encoder/CCAM (computer-controlled analogue memory) panel (hinged on the control panel back on the KT3), next to the TMS1000 board and finally to the teletext decoder.

VST and TRDIV

Up-market models apart, VST is the current system for all remotes and teletext models. The MSM5840H chip on the VST board does the combined work of the control, the encoder/CCAM and the TMS1000 boards on RC5 KT3s. Tuning is by a yellow band that moves across the screen from ch. 21 (left) to ch. 68 (right) and stops at all stations. When you get to one you want it can be stored in any of twenty programme cells. Granny setting of the analogue controls is done in the same way. The VCR cell is 0: the a.f.c. doesn't like double-sideband signals much and may shoot past the VCR or computer signal (if this happens, go round again and slow the action down with the fine tuner +/− buttons just before the VCR etc. signal arrives). Memory is retained by a nicad battery on the board. Remember this when servicing – the memory is still going when you have the board in your hand. There's a systematic fault-finding procedure that can be followed after grounding pin 16 of the microcomputer i.c. VST boards in the CTX, K35 and KT4 chassis don't interchange.

TRDIV is the up-market version of VST, with many extra code possibilities that come in handy with stereo models and the set that has a built-in teletext printer. It's distinguished from the VST systems by the ability to select channels by number, to store them in fifty different cells, and the absence of an on-screen tuning bar. Some models have "Supertext" which is the ability to store teletext page numbers in cells – this doesn't improve the access time (only a bank of RAMs on the teletext panel would make that possible). The microcomputer i.c. doesn't have the same service mode facility as with VST, but under certain fault conditions shows error indications on the 99-digit display in "calculator overload" fashion.

Simple IR Remotes

Simple IR remotes offer channel selection by stepping up/down, volume control and standby. KT3s use a TMS1000 board and Telco handset codes. CTX sets use a similar circuit with RC5 codes. Monochrome TX sets use much the same arrangement as in the CTX chassis. Incidentally the CTX/S has a large ELC2003 tuner and is produced in Singapore. The CTX/E has a small U411 tuner and is produced in Europe. There are many electrical differences between the two versions.

Simple US Remote

Finally a simple US remote control system was used with two TX 12in. portables, giving channel change and standby only. The action is very slow and the electronics consist of discrete components on a subpanel.

List of Models

Table 1 lists the various remote-controlled models and the systems used.

Testing Handsets

When it comes to testing handsets in the workshop, the usual trouble is to find a set with which to check them. Apart from the early Dynatrons and simple remotes, which call for a frequency counter, most types can be dealt with using very simple test gear.

For US handsets, use a good transducer connected to a scope's Y amplifier (set to near maximum gain) to receive the signals. The scope's screen will tell you all about the handset's performance, range and, roughly, its operating frequency. A typical US display consists of bursts of about 10mV peak-to-peak amplitude.

To test IR handsets use the same set-up but with an eyeball type IR receiver (eyeball plus IR preamplifier) – the best one to use is from the eight-way G11 remotes or teletext units. Connect the preamplifier's output pin to the scope's Y input, set at about 2V/div. Power for the receiver can be from a 9V handset battery (it takes only 5mA). Pulse trains of about 5-7V amplitude should be seen with a working handset. The eyeball receiver mentioned above, using discrete components, will test any IR system. Other receivers with decoder chips work well only with their own system.

A small meter unit reading 10V or 30mA interposed between the battery and the handset under test gives a good indication of its performance. Most IR transmitters show a pulsing current of 15mA or more when a button is depressed. A good battery should not show a dip of more than 1·5V when a button is pressed. Fluids spilt into the handset show a constant leakage current, and in bad cases send data to the set continuously.

Although almost any good US transducer will do for the US test described above it's important to fit the right one when making a repair. The transmit and receive transducers have offset resonances to produce a bandpass effect with equal sensitivity on all signals. Using the wrong mix will reduce the range with some commands. With the G11, also look out for the wiring of the receiver's transducer plug – not all use the same two pins.

Table 1: What's in which set

Model	*System*
Dynatron	
CTV9-14	Wired remote, no standby
CTV15-19	Wired remote with standby
CTV20-25	US full remote
CTV33	US full remote
CTV41	G11 US full remote
CTV43	G11 US full remote
CTV50	G11 US full remote
CTV54	G11 US full remote
CTV55	G11 US full remote
CTV59	G11 US full remote
CTV60	G11 US full remote plus phase 1½ teletext
CTV61	G11 IR full remote plus phase 2 teletext
CTV62-64	G11 IR full remote
Philips	
G22K556	G8 pinger
G22K566	G8 pinger
G22K567	G8 pinger
G22K569	G8 pinger
G26C583-586	G9 pinger
G26C594-595	G9 US teletext only
G26 C597	G9 US teletext only
G22C661	G11 US full remote
G22C662	G11 US simple remote
G22C663	G11 US full remote
G22C664	G11 US simple remote
G22C665	G11 US full remote
G22C666	G11 US full remote plus phase 1¼/1½ teletext
G26C671	G11 US simple remote
G26C672-673	G11 US full remote
G26C674	G11 US full remote plus phase 1 teletext
G26C675	G11 US with viewdata
G26C676	G11 US full remote
G26C678	G11 US full remote
G22C701	G11 IR full remote
G22C703	G11 IR full remote
G22C705	G11 IR full remote
G22C706	G11 IR full remote plus phase 2 teletext
G22C708	G11 IR with viewdata
G26C722-723	G11 IR full remote
G26C724	G11 IR full remote plus phase 2 teletext
G26C726	G11 IR full remote
G26C728	G11 IR full remote
G26C730	G11 IR full remote plus phase 2 teletext
G26C731	G11 IR with viewdata
797	K12 Telco
912	TX US simple remote
928	KT3 Telco
934	KT3 Telco
1201	K30 Telco
1205	K30 Telco
1234, 1250	K30 RC5 Teletext/full remote
2206	CTX simple remote
2216	CTX VST
2226	CTX VST
2601	K12Z Long 868 video centre
2605	K12Z Long 868 projection
3205	KT3 simple remote
3215	KT3 simple remote
3245	K35 VST
3275	K35 VST
3715, 3723	KT3 RC5 Teletext/full remote
3745, 3775	K35 VST plus teletext
3850, 3880	K35 TRDIV plus teletext
3890	K35 TRDIV, Supertext plus printer
3895	K35 TRDIV plus Supertext
4206	KT4 TRDIV plus teletext
4360	K40 TRDIV
4418	KT4 TRDIV
4616	KT4 TRDIV plus teletext
4626	KT4 VST plus teletext
4718	KT4 TRDIV plus teletext
4728	KT4 TRDIV plus teletext
4860	K40 TRDIV plus teletext
4880	K40 TRDIV plus Supertext
6620	KT4 TRDIV plus teletext
6720	K40 TRDIV plus teletext
6820	K40 TRDIV plus teletext
Pye	
CT452	G11 US simple remote
CT454	G11 US full remote
CT457	G11 US full remote plus phase 1¼/1½ teletext
CT462	G11 IR full remote
CT464	G11 IR full remote
CT467	G11 IR full remote plus phase 2 teletext
CT468	G11 IR with viewdata
CT474	G11 IR full remote plus phase 2 viewdata
CT481	G11 US full remote
CT483	G11 US full remote plus phase 1 teletext*
CT484	G11 US with viewdata
CT492	G11 IR full remote
CT493	G11 IR full remote plus phase 2 teletext
CT494	G11 IR with viewdata
194	TX US simple remote
1022	K30 Telco
1042	K30 Telco
1062, 1152	K30 RC5 Teletext/full remote
1826	K12 Telco
2013	TX2 IR simple remote
2056	K12Z Long 868 projection
2062	CTX simple remote
2162	CTX VST
3052, 3062	KT3 simple remote
3152	KT3 simple remote
3157, 3237	KT3 RC5 Teletext/full remote
3267	KT3 RC5 Teletext/full remote
3457	K30 RC5 Teletext/full remote
3508	K35 TRDIV plus teletext
3757	K30 RC5 Teletext/full remote
3808	K35 TRDIV plus teletext
3908	K35 TRDIV plus teletext and printer
4146	KT4 VST plus teletext
4184, 4187	KT4 TRDIV plus teletext
4266	KT4 VST plus teletext
4284	KT4 VST
4287	KT4 VST plus teletext
4309	KT4 TRDIV plus teletext
4508, 4509	K40 TRDIV plus teletext
4808	K40 TRDIV plus teletext

*CT483/1 phase 1¼, CT483/2 phase 1½.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1.00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 49 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

ITT CVC9 CHASSIS

We've had the same problem with several of these sets – poor convergence of blue verticals and, more important, a bowing of the red and green horizontal lines, particularly on the right of the screen about a third of the way down. Most of the relevant components on the convergence panel have been checked but they all seem to be within tolerance.

Sometimes the blue verticals on one side of the screen fall on the "wrong" side of the yellow crosshatch so that no blue width adjustment will get it right. The trick is to rotate the radial convergence yoke to equalize the error, then readjust the blue lateral dynamic convergence. For the red/green bowing effect D58z and D59z are worth checking, but the problem is probably due to tolerances in the scan yoke/tube combination. Try to distribute the error along the line, even off-setting the static convergence a tiny bit if necessary.

PANASONIC U1 CHASSIS

This set (Model TC2203) was completely dead. Checks in the power supply revealed that D809 and D818 were short-circuit, so these components were replaced and the set powered via a variac. We find that the h.t. voltage reaches the correct figure of 160V with a mains input of only 120V.

D812 should first be replaced as it could have been damaged when D809 went short-circuit. Then check the h.t. preset R810 which could be at fault. The range of the regulator in this chassis is very good however, and you may well find that with the h.t. set at 160V it will remain constant with a mains input right up to 240V. If the h.t. rises above 170V as the input is increased, check the error amplifier transistor Q803 and the chopper transistor Q801 which could be leaky or short-circuit.

ITT CVC20

The tripler was sparking to chassis and the power supply then tripped. A new tripler was fitted but all we have is a weak, colourless picture with the brightness control turned up. The contrast control has no effect at all.

The sparking tripler will have damaged components in the beam limiter circuit. Replace D3 and C7 and if necessary check the transistors T1 and T2.

RANK T20 CHASSIS

The fault on this set is intermittent though it's now present most of the time. The picture disappears, leaving just snow or maybe a faint, snowy picture, as though there's a severe loss of gain. The aerial and tuner connections seem to be o.k., and I've tried feeding the signal to the collectors of the transistors in the tuner. I've also tried new i.f. transistors. Heat and cold don't affect the fault and no amount of tapping will cure it.

Arm yourself with a 10kΩ potentiometer and a 6V or 9V battery so that you can apply a variable bias to the tuner's a.g.c. input. Adjust for maximum gain, probably around 2-3V. If a noise-free picture can be maintained with the a.g.c. thus overridden, suspect the TCA270Q vision demodulator/a.g.c./a.f.c. chip. If the snow persists, change the tuner.

PHILIPS N1700

The problem is intermittent field jitter. Constant adjustment of the tracking control minimises the problem.

This symptom is usually due to a fall-off in the video f.m. envelope at the beginning of the head scans, so that the field sync pulses are noisy or partially obliterated. It may be that head cleaning and careful adjustment of the head entry guide will clear the fault. If not it's likely that the heads are worn, with the result that there's insufficient tape penetration at the extremes of the head wrap.

ITT CVC32 CHASSIS

There's a wasp-waisted picture, also a white band across the top of the screen. The field hold and height controls had to be set to maximum but a new BU208 put that right by bringing the voltages up.

The wasp-waisted effect is almost certainly due to failure of the 320V supply reservoir capacitor C35 (220μF). More remote possibilites are C37 (10μF) and the 12V zener diode D801 – these components stabilize the 12V supply to the switch-mode power supply control i.c.

SIEMENS FC211/SHARP VC9700

With this combination I get picture pulling on prerecorded tapes – some tapes won't play at all. Any ideas for modifications in the TV set's line sync circuit?

Our experience has been that these Siemens sets are not very happy with VCR operation. The line timebase is unusual in employing a BR101 SCS as the oscillator. You could try reducing the values of the capacitors in the flywheel sync filter circuit. The ones to go for are C2 and C27, both 4·7μF – try 2·2μF or 1μF. C9 could also be reduced from 0·01μF to say 0·0047μF.

SHARP C2072

There's occasional colour dropout on change of station or scene. Changing channels four or five times restores the colour. The set's tuning has been checked and doesn't seem to play a part in the fault condition.

Earth TP803 when the fault is present. If this results in horizontal bands of colour it may well be that the reference oscillator has drifted, in which case adjustment of R811 (preferably by the method given in the manual) may be all that's required. If the result is no colour, check Q801 and Q802 (both 2SA495) before suspecting the decoder chip I801 (RH-1X0063CE).

FERGUSON 3V00

There's a distinct left-right movement of the picture on playback, with smearing of the reds to the left of the image. At worst the picture is unwatchable.

The usual causes of this fault are wear of the pinch roller or incorrect back tension adjustment. Remove the pinch roller, taking great care not to apply any downward pressure on the screw, and check against a straight edge.

Any wear will be shown by light passing between the two. Adjustment of the back tension can be done only with the correct jigs. Less likely causes of the trouble are either motor defective or a tape path fault causing the lower edge of the tape to ripple as it passes the control head.

TEST CASE

263

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

Mrs. Waghorn rents a little Japanese colour set from us and has done so for many years. Like most of its ilk, it has given very little trouble. Until a week ago that is. "It keeps going into lines dear – I haven't seen the nine o'clock news for days. Come and have a look at it." So off we went.

It's a Panasonic TC481GR – M6A chassis, similar to the TC333G – and in our experience is a very well behaved model. It was behaving the day we called. Good line lock, clear pictures – another intermittent fault! We wondered about Dave, six doors along. He's got a CB rig, and if the rig itself is legal the aerial it's hooked to certainly isn't. The BBC themselves would have been proud of Dave's transmitting aerial. We got him to fire up his rig, and with his "1–4 for a copy . . . 1–4 for a copy" ringing in our ears we went hotfoot back to the Waghorn residence. The TV was quite unaffected. We set up the line hold and away we went.

The inevitable phone call came next morning. It was arranged that the set would be left running and that we would call later in the day. That afternoon we finally saw the effect – complete loss of line hold, and the best the line hold control R511 could do was to straighten the picture momentarily before it took off again, with a wild squealing from the line output section. We loaded up the set and bore it back to the peace and privacy of the workshop.

The line oscillator and flywheel sync circuits are quite conventional, consisting of a transistor sinewave oscillator stage and a double-diode discriminator circuit, with the usual filtering etc. We decided that the germanium discriminator diodes D501/2 were the most likely culprits, so in went a matched pair of OA91s. Four hours later we found that the picture was jittering sideways with a "false line lock" effect. Strangely, cooling the oscillator section had no effect on the fault. While it was present we took the opportunity to monitor the line sync pulses, which were correct, and the flyback sample pulses, which were of correct amplitude but out of lock as the timebase had once more become totally unhinged. The line hold control's track was checked and found to work smoothly, and a physical assault on the line oscillator coil T501 with the handle of a screwdriver had no effect. Finally the picture came back into lock and stayed there.

Next came the weary business of substitution and soak tests. The oscillator circuit tuning and coupling capacitors C510 and C509 were exonerated in this way, as were most of the components in the flywheel sync discriminator and filter circuits, including the reservoir capacitor C506 and the anti-hunt capacitor C507. Supply filter capacitor C508 was also proved innocent by substitution.

By way of experiment we connected a low-impedance voltage source to the oscillator in place of the error output voltage from the sync circuit. While sync was of course lost, the line frequency remained reasonably constant. Armed with this useful clue we finally struck gold and cured the problem once and for all. It's only fair to add that in most sets using circuitry of this type the fault couldn't arise. What was the cause of the trouble? You'll know next month – if you don't suss it out meanwhile.

ANSWER TO TEST CASE 262
– page 679 last month –

We were in the conversion business last month, with a W. German Sharp VCR of the VC3300 variety. You'll perhaps recall that our enterprising lads had converted its intercarrier sound strip to 6MHz by changing the filter and retuning, and had changed the relevant traps in the video circuits.

Traps in fact were the key to the remaining problem! The vision i.f. strip includes a series of filters and traps for tuning and rejection. In common with most current i.f. designs, bandpass shaping is carried out by a SAW filter – its designation is SF1501. By leaving the original SAW filter in circuit, the adjacent sound and vision filtering and the co-sound notch were all at the wrong frequencies. While this had little effect in the "quiet" area of the local workshop, it was otherwise in some of the districts in which the machine had been used – hence the patterning and buzzing effects.

A complete cure was achieved by replacing the SAW filter with one of the type used in UK machines. This had to be done at no charge of course, which removed the profit from the job. The old bits are being held on to in case the owner ever decides to return to W. Germany with the machine – any ideas as to how to retune the modulator sound to 5·5MHz spot on?

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BD139	20p
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BD144	90p
BD150	30p
BD157	38p
BD158	38p
BD166	30p
BD175	30p
BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD183	60p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p

BD225	31p
BD232	31p
BD234	32p
BD237	21p
BD238	24p
BD433	28p
BD437	28p
BD535	38p
BD536	38p
BD537	40p
BD538	40p
BDX32	100p
BDX65	80p
BF180	16p
BF181	18p
BF183	20p
BF184	20p
BF185	20p
BF194	5p
BF195	5p
BF196	6p
BF199	6p
BF200	16p
BF240	16p
BF241	10p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF336	20p
BF337	20p
BF338	20p
BF362	30p
BF422	21p
BF458	19p
BF459	19p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BYF57	25p
BFY64	25p
BFY90	60p
BR100	14p
BSX20	15p
BT106	90p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BU104	100p
BU105	80p
BU108	100p

BU110	110p
BU111	140p
BU126	70p
BU204	75p
BU205	70p
BU208	75p
BU208A	80p
BU208D	120p
BU326	85p
BU406	85p
BU407	75p
BU408	100p
BU500	110p
BU526	80p
C106D	23p
MJ2500	100p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
OC28	100p
OC29	80p
OC35	100p
OC36	120p
OC45	50p
OC71	30p
DC72	50p
OC200	180p
R2008B	80p
R2010B	80p
TAG06-60	42p
TAG521-200	72p
TAG4443	76p
TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	16p
TIP31A	24p
TIP32	24p
TIP32A	24p
TIP33	50p
TIP34	50p
TIP41A	22p
TIP41C	25p

TIP42A	22p
TIP42C	25p
TIP47	40p
TIP48	40p
TIP110	47p
TIP112	54p
TIP115	45p
TIP117	56p
TIP120	43p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	56p
TIP147	100p
TIP2955	34p
TIP3054	38p
TIP3055	34p
TIS43	45p
TIS44	40p
TIS61	15p
TIS88A	45p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN.10KM	60p
VN.46AF	88p
VN.66AF	100p
VN.88AF	115p
VN.89AF	110p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX326	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N.1131	28p
2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p

2N.2484	20p
2N.2646	38p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	35p
2N.3055	32p
2N.3055H	38p
2N.3440	58p
2N.3442	85p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3771	85p
2N.3772	90p
2N.3773	100p
2N.3819	29p
2N.3866	68p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4443	76p
2N.4444	76p
2N.5061	20p
2N.5294	30p
2N.5296	30p
2N.6106	40p
2N.6107	40p
2N.6109	40p
3N.128	55p
3N.143	65p
JAPANESE TRANSISTORS	
2SA73	30p
2SA104	32p
2SA198	22p
2SA203	30p
2SB54	25p
2SB77	32p
2SB337	120p
2SB405	22p
2SC460	21p
2SC495	60p
2SC733	40p
2SC1161	110p
2SC1172Y	150p
2SC1279	24p
2SC1306	100p
2SC1307	100p
2SC1520	25p

2SC1969	130p
2SC2029	120p
2SC2078	120p
2SC2122A	200p
2SC2952	27p
2SD234	37p
2SK135	400p
MB3712	150p
TA7205	90p
UPC575	100p
DIODES	
AA119	9p
BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	22p
BY176	85p
BY179	35p
BY182	32p
BY184	32p
BY187	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY223	72p
BY225	120p
BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BY476	90p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX55/800	32p
BYX70/300	29p
BYX70/500	31p
BYX70/800	36p
BYX71/600	80p
OA47	6p
DA90	4p
A091	4p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p

IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN.4148	2p
IN.5400	9p
IN.5401	10p
IN.5402	10p
IN.5403	11p
IN.5404	11p
IN.5405	12p
IN.5406	13p
IN.5407	13p
IN.5408	13p
LOW PROFILE SOCKETS	
8 pin	6p
14 pin	8p
16 pin	9p
18 pin	12p
20 pin	14p
22 pin	16p
24 pin	18p
28 pin	20p
40 pin	25p
ZENERS	
400MV BZY88 Range 2V7 to 39V	6p
1.3W Zeners BZX61 Range 2V7 to 39V	12p
VOLTAGE REGULATOR	
7805	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L12	28p
78L15	28p
78L18	28p
74L24	28p
79L05	40p
79L12	45p
79L15	48p
LM309K	100p
LM317K	220p
LM317T	180p

LM323K	420p
LM723	32p
78HGKC	570p
78H05KC	520p
78GU1C	190p
79GU1C	215p
79HGKC	670p
VALVES	
DY87	53p
DY802	45p
ECC82	40p
ECC83	43p
ECC84	40p
ECC85	40p
ECH81	49p
ECH84	52p
ECL80	57p
ECL82	59p
ECL84	57p
ECL85	57p
ECL86	49p
EF80	31p
EF85	34p
EF89	43p
EF183	45p
EF184	53p
EL34	190p
EY86	31p
EY87	31p
PC97	100p
PCC85	42p
PCF80	58p
PCF200	135p
PCF801	110p
PCF802	57p
PCF806	115p
PCH200	100p
PCL81	54p
PCL82	63p
PCL84	50p

PCL85	55p
PCL86	55p
PCL805	55p
PFL200	85p
PL36	80p
PL504	95p
PL508	190p
PL519	450p
PY81	70p
PY88	48p
PY500A	160p
CMOS	
4000	27p
4001	27p
4002	27p
4006	80p
4007	27p
4008	65p
4009	50p
4010	50p
4011	27p
4012	27p
4013	50p
4014	60p
4015	60p
4016	45p
4017	65p
4018	60p
4019	60p
4020	75p
4021	58p
4022	58p
4023	27p
4024	47p
4025	26p
4026	80p
4027	38p
4028	48p
4029	55p
4030	36p

4032	67p
4034	145p
4035	70p
4038	71p
4040	57p
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4042	58p
4043	57p
4044	56p
4047	65p
4048	49p
4049	40p
4050	40p
4051	62p
4052	61p
4053	61p
4054	85p
4055	90p
4056	85p
4060	72p
4066	42p
4068	25p
4069	27p
4070	27p
4071	27p
4072	27p
4073	27p
4075	27p
4076	70p
4077	27p
4078	27p
4081	27p
4082	27p
4093	45p
4094	85p
4098	85p
4099	82p
4501	40p
4502	55p
4503	52p
4504	75p

4506	110p
4507	45p
4508	125p
4510	57p
4511	57p
4512	57p
4513	120p
4514	110p
4516	65p
4518	65p
4520	65p
4522	60p
4526	80p
4527	60p
4528	65p
74 SERIES	
7400	22p
7401	16p
7402	18p
7403	22p
7404	18p
7405	10p
7406	100p
7407	80p
7408	25p
7409	20p
7413	35p
7414	45p
7417	32p
7420	22p
7421	25p
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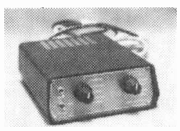

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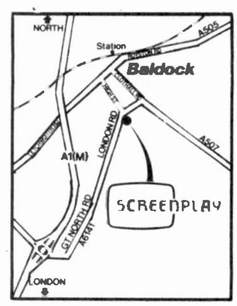

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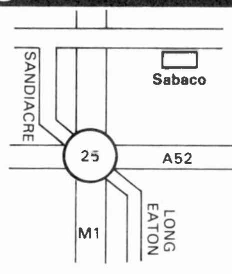

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SENDZ COMPONENTS

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KT3 (Export) 12 P.B.u	£2
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7 Lamps for P.B./Unit	10p

Mains Droppers

G8 2R2+68R	£1.25
G8 47R 15 watt	75p
Pye 731 3+56+27R	50p
Pye 3R5/15R/45R	50p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/10/6 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ae Socket & Lead GEC, ITT, Philips, Pye	25p
7×3½ Thorn	£1
Rank Toshiba Tube Bases	30p

Speakers

6×4 G11	25 ohm	70p
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6¼" dia	4 ohm	£1.50
6¼" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4½" sq.	15 ohm	75p
KT3 speaker		75p
3" dia	15 ohm	60p

K30

OF-550	10p
OF-513	10p

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600: 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228	20p
BY 229/400	30p
International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p
XK 3123	50p
Hitachi 2A/1500V metal case wire end	20p

20.AX

GEC Degausing Panel 809 with PT37	£1.00

Line Transformers

G8 Symmetry Coil	£2
G8 Trans. Philips	£6
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B/W AD5308F + Stik + Lead	£1.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono T704A	£3.50
CVC20 ITT	£3.50
CVC32 ITT	£7.50
CVC800 Line Trans	£6.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
EHT Cable/Metre	20p
Ex panel "14" Fidelity portable	£5

Triplers

8500 Triplers	£6.50
11 TEZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.50
9000 Thorn	£5
9500 Thorn	£4.50
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
TVK 76/9	£3.00
G8 Philips (Mullard) with cap	£4.50
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
BG 100/61	£3.25
KT3 BG200/43	£3.50
T/text ultrasonic rec'r panel	£14.00
Video cassette lamps on lead. 12-14V.	50p or 3 for £1.00
20 for £5.00	200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots	£4.00
G11 E.W. coils	£1.00
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£3
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	25p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O.P. Trans.	pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P.B.U.	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
G11 Line Driver Transformer	35p
KT3 Front Panel Control Assy.	£2.50
BTW 30/50	50p
BTW 92/800R	£3
25A473 PNP C/P	10p

NEW PYE 725 line O/P panel with L.O.P.T. & Tripler	£10.00
Thorn Mains Isolator unit for 70-80Ω. Ex-speaker	£2
NEW GEC 20AX Power Supply Switch Mode	£12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI	£10
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPTI	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 line O/P panel with transformer + tripler	£12.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
Pye 607/205 Line panel with transformer	£10.00
Pye CDA/205 panel	£6.00
GEC portable chassis + LOPTI 2114 New	£4.00
Thorn 1613/1713 chassis	9.75
Hills 520 multimeter – case. 20,000Ω/volt, fuse diode protected + logic test facility. 10meg/1200 volt	£19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230)	£15.00
Panel 6101	£15.00
Panel 6330	£15.00
G8 Tuner Unit + Panel	£6.00
G8 Convergence Panel (late type)	£12.00
G8 Power Supply	£6.00
G8 6 Sloping PBU	£8.00
G8 IF & Chroma	£12.00
G8 Chroma	£6.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q	£2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+ SC9503P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
GEC Power Supply (Export)	£10.00
G11 dynamic correction panel	£6
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots	£14
CVC 5 Mains on/off + 5 pots	£2
Universal Focus. Fits Pye, Thorn and Decca Units.	
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
CVC 32 Focus Unit	
Focus Rod	25p
G11 focus	£2.00
ITT Small for use with Split Diode	50p
TV11	50p
Remo TV12SP	50p
TV13	50p
TV14	50p
TV18	60p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p
16 Button Key Pad 1 to 0 + * + #+ 4 blank (Cherry)	£3.00

Condensers

470/16	6p
1500/16	20p
3300/16	20p
10000/16	25p
15000/16	50p
3300/18	20p
47/25	5p
470/25	5p
680/25	5p
1000/25 Radial	10p
1500/25	10p
3300/25	20p
4700/25	25p
5000/25	25p
3500/30	20p
470/35	6p
2200/35	25p
100/40	5p
220/40	5p
400/40	20p
1250/40	20p
1500/40	20p
2500/40	25p
1000/50	20p
1250/50	25p
2000/50	20p
3000/50	25p
3300/50	25p

TELETEX DECODER

I.C. SAA 5051	
I.C. SAA 5042	
I.C. SAA 5030	
I.C. SAA 5020 etc.	£18.00

DISPLAYS

4040 Clock	£1
7seg Red LED	50p
2 digit LED 8.8	50p
2 digit LED ÷1.8 with panel + MC14511	£1.00
4700/63	£1.50
250/64	10p
3300/70	50p
.1/100	5p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
2000/100	70p
4700/100	75p
47/160	10p
800/160	50p
.1/250 Pulse	5p
G11 0.47/250	10p
2,2 250v	10p
3n3/250 A.C.	10p
.33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
.91/250	35p
.91/400	30p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC600/250	60p
700/250	£1
800/250	40p
32/300	20p
4/350	5p
8/350	8p
12/300	10p
4.7M/350v	10p
16/350	25p
33/350	20p
50/350	10p
220/350	30p
300/350	40p
400/350	50p
10/375	10p
22/375	15p
220/385	75p
330/385 CVC 820HT	60p
0.1/400	15p
KT3 E/W .39/400	20p
.56K/400v	20p
4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	40p
394K/400V	20p
220/450	40p
47/500	25p
0.1/600	15p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.15/1000	20p
.47/250V A.C.	10p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
G11.11000/1500	15p
.01/1600	15p
G11.8200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
0.0015/2KV	10p
5n2/2KV	10p
6n2/2KV	15p
2n0/2KV	15p
2n2/2KV	15p
7500pf/2KV	10p
4n7/2KV	15p
8n2/2KV	15p
0.0082/2500	15p

Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Mains Remote Switch 2865 ohm	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
THORN Rotary Mains Switch	50p
G8 Mains Switch	75p
Thyristor 600/4 amp C106/2	24p
G11 Preh Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
CVC 5 Mains on/off +250K+100K+500K+50K+500K Pot on Panel	£2.00
Thorn 12 or 24 volt battery convertor for portable colour T/V	£12.00 Post £1

150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
170/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
210/12KV	10p
1000/12KV	10p
1200/12KV	10p

Multi-Caps

470/250 G11	10 for £15
Thorn 3500	
175/100/100/350v	£1.75
KT3/200/25/25/385v	£1.00
300+300+150+100+50MFD 350V	£2
47/220/350v	60p
150/150/100/100/100/320v	£2.00
2500/2500/63v	50p
470/470/250v	50p
150/200/200/300v	70p
400/400/200v	£1.70
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
300/300/100/32/32/300v	2.00
1500/2000/30v	50p
Jelly pot Thorn 00D4/013	£3
150/150/100/100/320v	£2.00
100/350 + 300/200/100/16/275v	£2.00
300+300/300	£1.00
225+25/380	70p
200/100/100/350v	£1.50
500/500/25v	50p
150/150/100/300v	75p
200/150/150/300v	1.00

ITT Panels

CVC 40/2 Chassis, new £30, complete	£20.00
CVC 820 Line O/P Panel	
CVC20 Mains Panel	£3.00
ITT 8 & 6 Push Button Unit	£1.00
CMA 10	£2.00
CMA 11	£2.00
CMA 30	£2.00
CMA 40	£1.50
CMC 10/2	£5.00
CMC 16	£4.00
CMC 38	£8.00
CMC 45	£1.50
CMC 47	£1.00
CMC 52	£15
CMC 57	£6.00
CMC 58	£8.00
CMC 59	£8.00
CMC 67	£3.75
CMC 67/2	£4.00
CMC 68	£4.00
CMD 12	£10
CMD 32	£5.00
CMD 33	£5.00
CMD 40	£5.00
CMD 41	£5.00
CMF 25	£2.00
CMF 26	£2.00
CMF 40	£2.00
CMH 10	£1.50
CMH 31	£1.00
CMK 12 (untested)	£4.00
CMK 30 (untested)	£4.00
CMN 20	£1.50
CMN 21	£1.50
CMN 40	£1.00
CMN 45	25p
CMP 10	£2.00
CMP 11	£4.00
CMP 40	£2.00
CMS 11	£2.00
CMS 40	£2.00
CMU 12	£10.00
CMU 14	£8.00
CMU 30	£7.00
CMU 45	£7.00
CMZ 30	£5.00
GMA 90	£5.00
GMC 120	£2.50
GMR 64	£5.00
TMN 2	£2.00
VCA 20	£10
VCA 21	£10.00
VMC 26	£3.00
VMC 34	£5.00
VMC 44 + 45	£4.00
VMC 51	£5.00

Hand Sets

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead	£3.50
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02	£16.00
G9 Philips R/C Transmitter	£8.00
Rank, Infra-red	£10.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy.	£12.00
G11, Full remote repair service (exchange unit)	£12.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
KT3-30 Push Button Kit	£3.00
KT3/K30 T/Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
Hitachi 8 button unit with resistor unit. Last year mod.	£7.00
GEC infra-red 2236-2026	£4.00
GEC push pad hand set button blobs	10p each